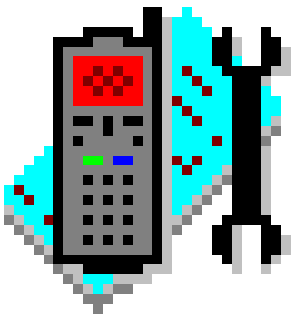
Programme’s After Market Services



Tesla For Windows

WinTesla User Guide

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Tesla for Windows Operating System

The name **TESLA**, when used by Nokia, is an acronym for **TE**st and **S**ervice **L**ocals **A**pplication. Tesla for WIndows (i.e. WinTesla) is a software package designed to operate in the Microsoft Windows environment. The software package is made of two modules, the Wintesla core module and a service software module. The Wintesla module is similar to an operating system for various service modules. In this way many Nokia products can be serviced using one common software package, running different service modules (in this case, for the Nokia 2180).

Note: *The Wintesla core module MUST be installed for "any" service module to run.*

Installing WinTesla On Your Hard Disk

The WinTesla core software is delivered on a 3.5" diskette and is protected with a protection "key" (PKD–1), which must be attached to the parallel port LPT 1 when the WinTesla service software is being used.

To install the WinTesla core software package, proceed as follows:

Note: *For instructions on installing the HD881 service module (see **Installing the HD881 Service Module**)*

Insert the WinTesla Application diskette into drive A: of your PC.

From DOS (NOT running windows) type
`A: INSTALL <Enter>` (Windows will boot up automatically)

Or

From Windows File Manager double click the mouse on
`a:\install.exe`

Follow the instructions given and use the *new* option when requested.

Repeat this procedure for the required module installation using the *upgrade* option instead of *new*.

Note: *For interim WinTesla releases use the **upgrade** option.*

Your Windows desktop will now have a "Service Software" group and a "Service Software" icon within that group.

To start the program, double click on the "Service Software" icon .

Using The Windows Interface

If not familiar with the windows type interface, consult the *Microsoft Windows User Guide* for further information.

Common User Interface

Due to the modular design of WinTesla, various generations of Nokia products can be serviced, while sharing a similar user interface. The common user interface is explained in the first part of this document and is followed by the specific module information.

The software can be used to control the phone by entering commands via the keyboard of a PC/AT – running MS Windows 3.1 or 3.11.

***Note**: Windows 95 and Windows NT are not supported.*

This document refers to WinTesla Version 4.60 or greater.

Equipment Required

- **Computer** : IBM 486 PC/AT or compatible with at least one, unused serial port, COM1 or COM2 one parallel port (LPT1), 5 Meg. hard disk space required, 16 Meg of RAM
- **Display** : Any supported by MS Windows version 3.1 or 3.11
- **Operating System** : DOS 5.0 or later running MS Windows 3.1 or 3.11
- **WinTesla Application Software** (product code 0774046)
- **Software Protection Key** PKD–1 (product code – 0750018)

Mechanical Connections

The software controls the phone via a separate adapter (DAU–2) connected to the serial port of the PC and to the phone's bottom connector using the Nokia proprietary communication method called M2BUS.

Attach the protection key PKD–1 to parallel port one (25–pin female D–connector) of the PC. When connecting the PKD–1 to the parallel port be sure that you insert the PC end of the PKD–1 to the PC (male side).

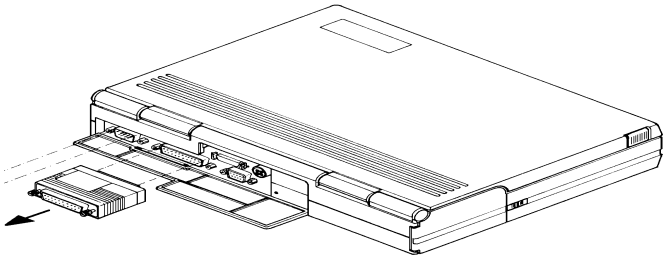


Figure 1. Dongle Insertion

The PKD–1 should not affect devices working with it. If some errors do occur try printing without the PKD–1 connected. If printing is now OK please contact your supplier who will endeavor to replace your PKD–1.

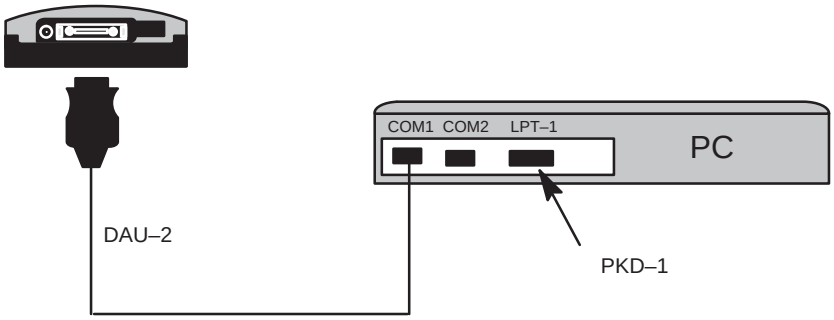


Figure 2. Servicing setup

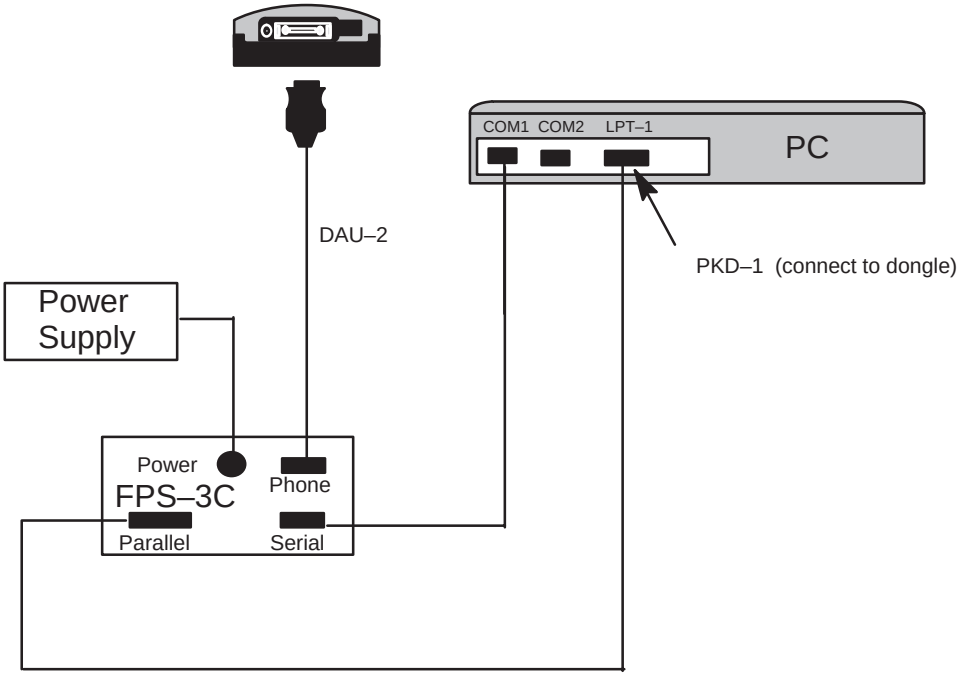


Figure 3. Flash setup

Using Wintesla

Phone Independence

The WinTesla application, “WinTesla.exe”, is phone independent. It relies on separate, phone specific, “modules” to provide communication, menus and test algorithms.

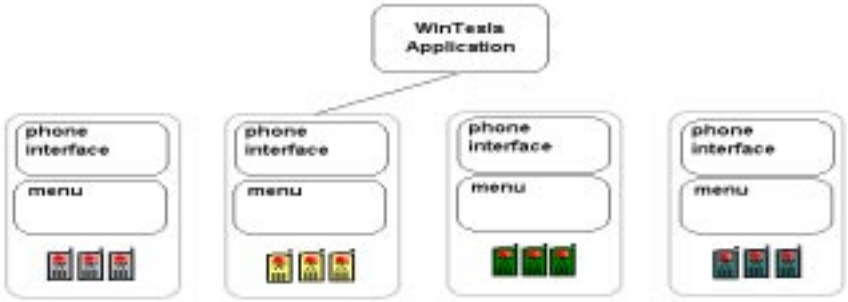


Figure 4. WinTesla with loaded interfaces

For each phone type – or product family – a phone interface module and menu module are required. The modularity of WinTesla allows support for other languages, so one phone type may have one phone interface module and several menu modules, all in different languages.

WinTesla allows you to select the language you wish to use (if available), and will automatically load the correct phone interface module for the connected phone. When a different phone type is connected, WinTesla will load the new phone interface and associated menus.

Login ID Setup

Once the software has been installed you need to set up your own Login ID (max. 3 characters). Start Windows file manager and locate the *validate\op_id.val* (located in the Wintesla subdir) file as shown in NO TAG.

Double clicking on the '*Op_ID.val'* file (a text file) gives a windows error message, in order to avoid this use the **File |Associate** command in file manager and link the file to the notebook application as shown below.

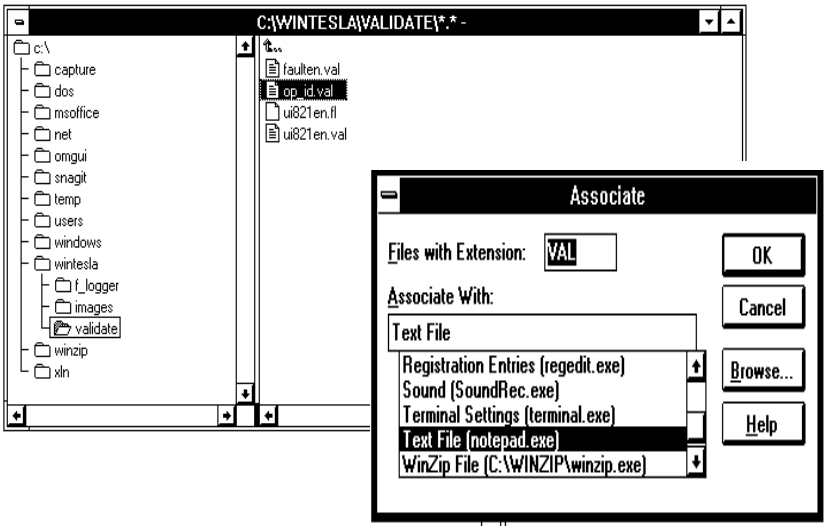


Figure 5. Accessing Op_ID. val file

Now by double clicking on the '*Op_ID.val*', notebook opens and your own ID can be entered and saved accordingly. Enter or edit any operator definitions following the existing format in this file.

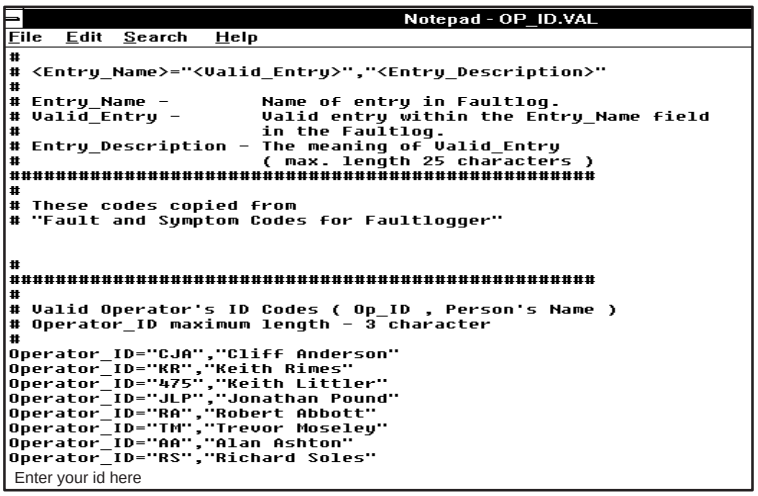


Figure 6. Editing Op_ID.val file

The Login Screen

When WinTesla first starts, the Login screen below will appear. Type in your 3 character ID and press `<Enter>` or click on the OK button.

Figure 7. Login Screen

If WinTesla can not find the file, *op_id.val*, which contains the Login IDs, then the OK button will be ‘greyed’.

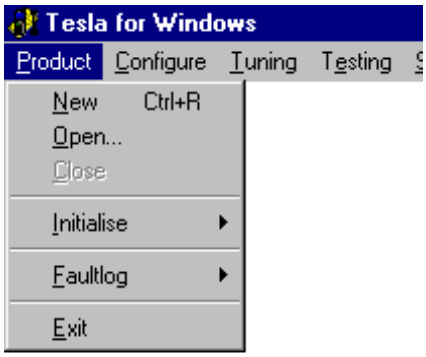
If CANCEL is clicked then the Fault Logging feature of WinTesla will be deactivated.

The WinTesla Screen

The main WinTesla screen – if no phone is attached – is displayed with 3 menu items at the top of the screen and a status bar at the bottom.

The information on the left of the status bar will be used to provide information when WinTesla is performing tasks: such as reading data from the phone. The status bar also includes the name of the current user.

The Product Menu



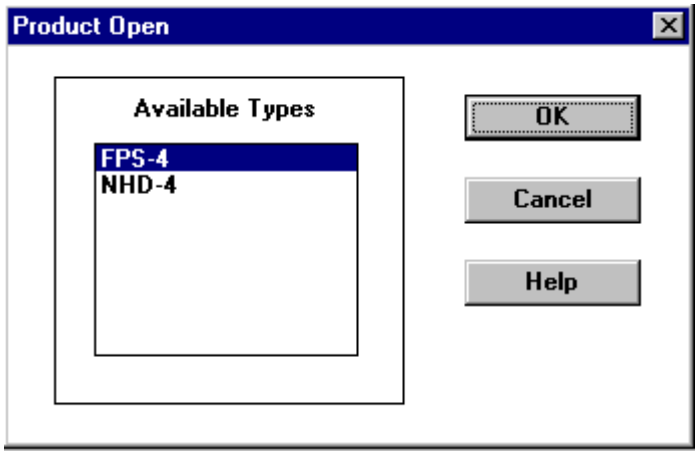
New (Ctrl+R)

The ‘New’ function (which can also be activated by pressing Ctrl+R) is used to scan for a phone when either the automatic rescan option is off or the automatic rescan timer has not expired (see **Configure|Options** section for automatic rescan).

If the phone type is unrecognized or unsupported by the current WinTesla system then a warning message will be displayed.

Open

The ‘Open’ function allows you to ‘force load’ a phone interface, even if there is no phone connected to the system.



A dialog box will appear and list the supported phone types (see figure above). To select a particular phone type to load; highlight the phone type name and click on OK.

Clicking on CANCEL will stop the request and no new phone type will be loaded.

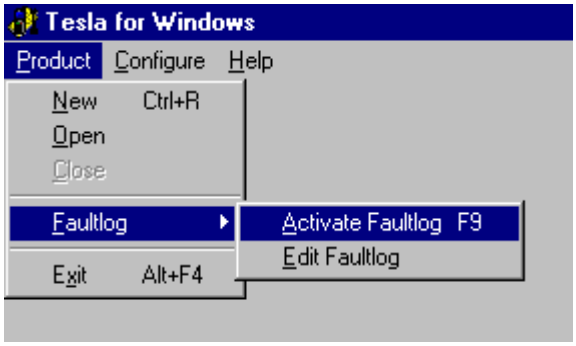
Loading a phone interface will disable the automatic rescan function (see **Configure|Options** section for automatic rescan).

Close

This function will close the currently loaded phone type interface that had been loaded using the **Product|Open** function. You can not ‘Close’ a loaded phone type interface if it was loaded by a rescan.

FaultLog

The ‘FaultLog’ option has a sub–menu (below). These functions are described in the ‘FaultLog Application’ section.

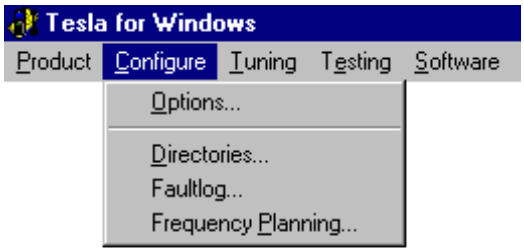


If the FaultLog function has been disabled – either because the Login ID was not correct or disabled through the **Configure|FaultLog** function – then these menus will be ‘greyed’ and made un–selectable.

Exit (Alt+F4)

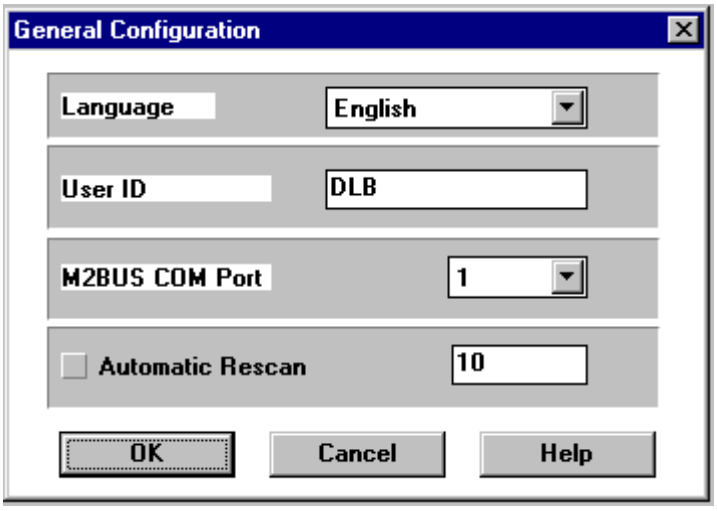
Selecting this option will shut–down the WinTesla program.

The Configure Menu



The configuration menu allows you to setup such things as directory paths, user interface language and FaultLog options.

Options



Language

This option allows you to change the language used in the WinTesla application.

Current Password / New Password / Retype Password

Currently not available

User ID

Allows the user ID to be entered if the users name is setup in the opt_id.val (validation) file.

M2BUS COM Port

This option allows you to select which communications port the phone is to be connected. The change will take place immediately after pressing OK.

Automatic Rescan

Automatic rescan is a mechanism to automatically check for a new phone; the time between re–scans is user configurable. When a phone is scanned and recognized, the corresponding phone interface and menu are loaded, extending the main menu at the top of the screen and displaying the phone type and description at the bottom of the screen.

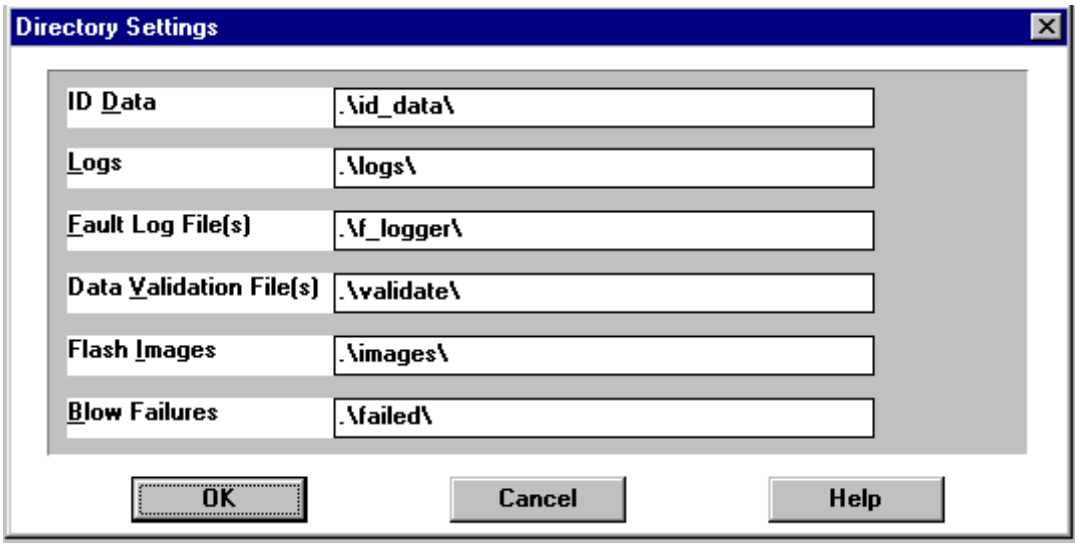
The **Product|New** (or **Ctrl+R**) function can be used to rescan the phone in–between automatic rescans or when automatic rescan has been disabled. The automatic re–scan mechanism is disabled when the **Product|Open** function is used to load a phone interface.

A tick in the check–box indicates that the automatic rescan option has been enabled. Clicking on the check–box (making the check–box blank) will disable the automatic re–scan option. The time between re–scans (in seconds) is entered into the edit box.

Pressing the OK button will save any changes made. Pressing CANCEL will discard any changes you may have made.

Directories

This function allows you to organize your data into different directories.



The directories must already exist. If an invalid directory is entered then an error message will be displayed (below).

The use of a backslash ('\') at the end of the directory name is optional.

Clicking on the OK button will save your changes.

Fault Log Configuration

Fault Log is a feature that allows the PC to create a record of each phone that is serviced for historical tracking. This function allows you to configure the FaultLog mechanism. Clicking OK after making selections, saves all changes made.

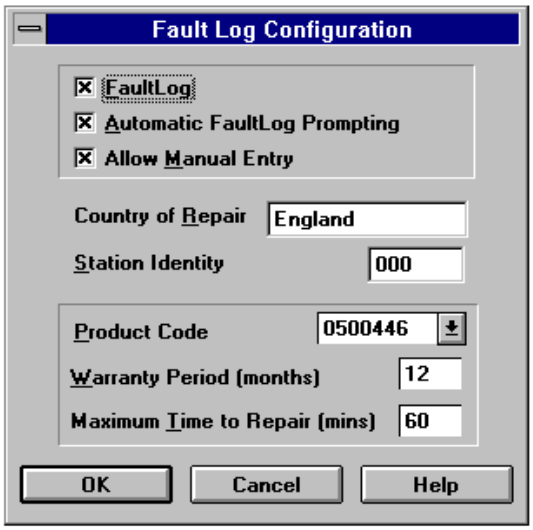


Figure 8. FaultLog – configuration

Fault Log

This option allows you to enable or disable the FaultLog mechanism. Choosing to disable the FaultLog mechanism results in the **Product |FaultLog** options being 'greyed' and the F9 button being disabled.

Allow Manual Entry

This option allows you to disable manual entry of data that was unavailable from the phone.

Automatic Fault Log Prompting

Enabling this option results in a prompt being displayed if the phone has changed.

Station Identity

Enter the unique identity of your 'workstation'; this ID is used to write FaultLog files.

Country Of Repair

Enter the country of repair.

Warranty Period (months)

Each product code has an associated warranty period. This option allows you to change those warranty periods. If no phone is connected then **all** product codes supported will be displayed. However, if a phone is connected then only the product codes associated with that phone type are displayed.

***Note**: Changing the Warranty Period in the Fault Log data file has no affect on the products warranty terms as stated from the manufacturer.*

Maximum Time To Repair (minutes)

Enter the maximum time allowed to repair a phone.

1. Fault Log Application.

The aim of the Fault Log application is to provide NMP After Sales Companies worldwide a standard method for the collection of Fault and Repair Data from their service process's. This information can also be used by NMP R&D and Manufacturing organizations as well.

The Fault Log application can be regarded as a data entry sub–routine run from the WinTesla Service Software package at the end of a repair. This allows for quick and uniform recording of the service performed on the product.

Each product repaired, will generate one unique record in a FaultLog file consisting of up to 37 data fields containing information about the product and how it was repaired. This information is read automatically where possible, from the products own internal EEPROM and then entered manually by the Service Technician to form a complete service record.

For more advanced implementations, the repair records are copied and collected by the electronic mail system installed in the Service Center and are sent electronically to a Central Service Database located in Finland.

Completing a FaultLog Record

Once WinTesla has been configured correctly it operates in the following manner:–

- Wintesla automatically reads the product details from the products EEPROM and writes them as a record to a pre–determined file.
- Proceed with the repair task, utilising a combination of software driven tuning and hardware modifications.
- On completion of the repair task you have a choice:

  A.)With the product still connected to the PC, manually display the repair data entry screen by selecting Function Button F9.

  B.) Alternatively, the product can be disconnected and the next product for repair connected in its place.

So long as Automatic Prompting is enabled then the previous products repair data entry screen will be displayed.

- Enter the repair work performed on the product in the repair data screen.
- Check the automatic data for this product, read earlier, to ensure its accuracy.
- When satisfied with the data, save the entry. This process adds a complete record containing the product details and the repair details to the FaultLog output file.

The output file can then be manipulated by a number of different systems, as required, as a detailed record of the product fault.

To attempt to record all of this information 37 data fields are defined for each FaultLog record. These can be split as follows:–

- Product definition information fields
- Repair / fault information fields.

Most products have their information stored in EEPROM, WinTesla automatically reads this information from the EEPROM and writes it to the FaultLog record. This part of the record is shown below.

Fields that are ‘greyed out’ etc. are data that has been automatically retrieved from the phone’s EEPROM. All other fields are entered manually; fields are summarized below.

Operator

Automatic:	Station, Country
Manual :	*Time to repair, Job ID, Operator ID*

Phone

Automatic:	Product code, Production SN, Order No., Hardware ID, Software version, Mfr. SN/ESN/IMEI, Mfr. Date, Issue date
Manual:	*Warranty*

Fault

Automatic:	none
Manual	*Module, Fault, Symptom, Circuit ref., Part Number*

The current FaultLog application allows for the entering of three priority levels of fault / repair information seen as *Primary, Secondary* and *Tertiary* faults.

The *Module, Fault* and *Symptom* fields have variables selected by the arrows alongside each respective field.

A comprehensive list of faults and symptoms as well as all current modules are already listed within the software. These three fields can be updated by accessing and editing the following files ias described in each file.

Field	DOS File
– *Modules*	nhd4en.val–
– *Faults, Symptoms*	faulten.val

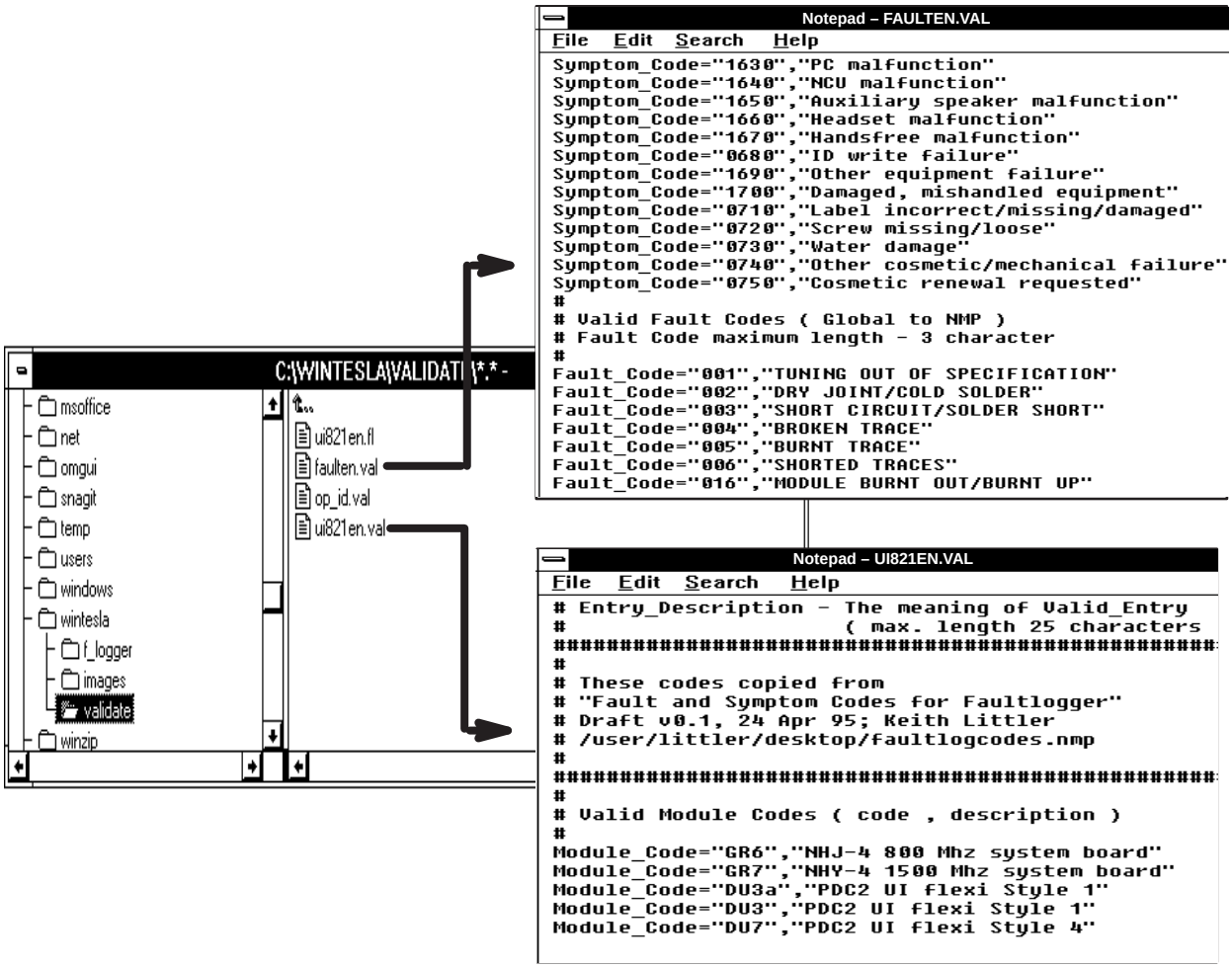


Figure 9. Editing fault, symptoms, modules files

Other Parts Replaced

Automatic	none
Manual	all fields

Enter other parts that have been replaced i.e. for wear and tear purposes etc..

This Entry

Automatic ; Entry Indicator, Date, Time

Manual ; *Comment*

Cost

Automatic ; Total

Manual ; *Parts, Labour*

This facility is for the use of third party repairers only

FaultLog Macros

The Macro sub–menu can be accessed by selecting the **macros** button on the FaultLog main screen.

Macro's in FaultLog are a set of standard repair actions defined and stored in order to represent frequently repeated repairs. These Macro's are related to the Product Code of the product, so whatever product is connected, FaultLog will display the Macro list for that particular Product Code.

A Macro's standard repair information can also be pasted into the FaultLog record for that product.

Macro's are saved initially under a name you can define yourself from the main FaultLog screen. All the information contained in the manually entered fields i.e. Module, Fault, Symptom, Circuit Ref and Part Number is recorded and saved under this name.

Setting up a macro

1. After completing a manual entry as normal but before saving the record, select the **Macros** button. This will bring you into the Macro definition screen.

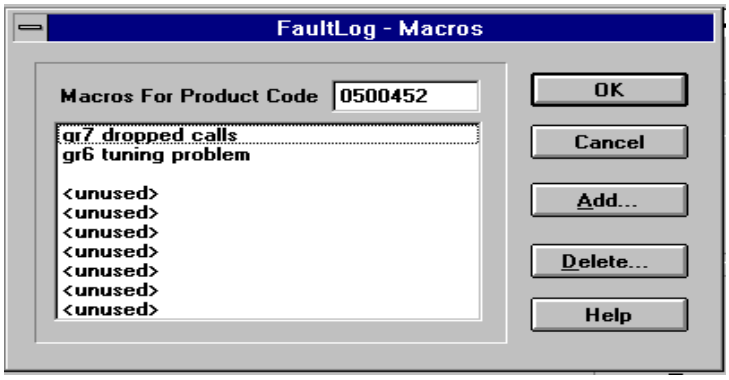


Figure 10. FaultLog – macro setup

2. Place the cursor over the next available Macro entry then select **Add**

3. Give the Macro record a meaningful name and press **OK**. You have now saved the repair data into a Macro for future use.

4. Use the **Delete** function to remove unwanted macros

Now, when a similar problem is seen with another unit you can recall this saved repair information into the units FaultLog record. If needed, the FaultLog record can be edited after being recalled to customize the repair before saving the FaultLog record.

There are a maximum of 10 Macro's definable for each Product Code. If an eleventh is required, it will be necessary to overwrite one of the previous Macro's.

The Macro definition file is called *macro.fl* and will be found in the path specified for the data validation files. If this path is a networked path all operators connected to the network will be permitted to share a common Macro list helping with reporting uniformity.

Help

An extensive help facility is available by clicking any screen or toolbar help button and features convenient hypertext linking for easy navigation.

HD881 Module

Information in this section is specific to the HD881 module and assumes that the setup procedures in the common interface section have been carried out.

Installing the HD881 Service Module

The HD881 Service module software is delivered on a 3.5” diskette and must be run under the Wintesla core software package.

To install the HD881 Service Module software, proceed as follows:

Insert the HD881 Service Module diskette into drive A: of your PC.

From Windows File Manager select the file `a:\install.exe` and press OK.

Follow the on screen instructions and select the *new* install option when prompted to do so.

Caution: *The service module requires the Wintesla core software application to be installed first for this module to function.*

Note*:* *Be sure to install the Service Module in the same directory as the Wintesla core software application.*

Required Servicing Equipment

The following is a list of equipment that is needed in order to service the HD881 family of products along with their respective product codes.

- **HD881 Software Service Module** (0774062)
- **Dongle ‘blackbox’ adapter DBA–**1 (0630044)
- **M2BUS adapte**r **DAU–2** (0750006)
- **RS–232 adapter,** 9–to–25 pins (4626170)
- **RS–232 cable** (0730090)
- **Centronics cable** (0730029)
- **Service cable SCS –1** (0770010)
- **Service cable SCS–10** (0775059)
- **Audio cable ADS–1** (0730011)
- **Modular cable XCM–1** (4626131)
- **Flash Programmer Set FPS–3C** (0271330)
- **Power connector PCS–1** (0730012)
- **Modular T Connector cable** (4626134)
- **Dummy Battery BTS–4** (0770009)
- **Covers off Jig JBS–8** (0770014)
- **Service box JBS–7** (0770015)

Equipment Setup

***Caution**: Make sure that you have switched off the PC and the printer before making connections !*

***Caution**: Do not connect the PKD–1 key to the serial port. You may damage your PKD–1 !*

Attach the protection key PKD–1 to parallel port one (25–pin female D–connector) of the PC. When connecting the PKD–1 to the parallel port be sure that you insert the PC end of the PKD–1 to the PC (male side). If you use a printer on parallel port one, place the PKD–1 between the PC and your printer cable.

Next connect the M2BUS adapter to the serial port (RS–232) of the computer. In case you are using a 9–pin serial port (normal with an AT set) use the mating adapter supplied with the M2BUS adapter.

Attach one end of the XCM–1 modular cable to the DAU–2 PC/M2BUS adapter and the other end to the JBS–7 service box. Use suitable adapter, SCS–1 service cable when the covers of the phone are in place, JBS–8 test frame with the phone covers off, and attach it to the phone. Then connect it to the service box.

Dealer Setups

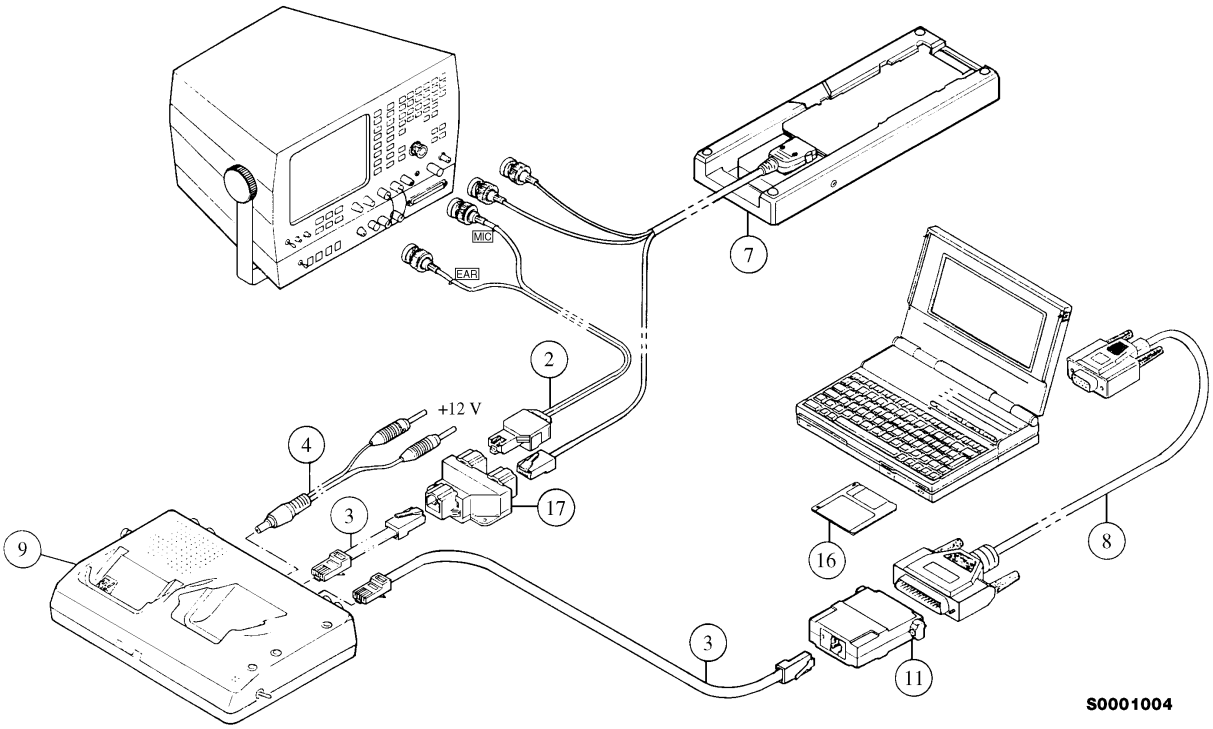


Figure 11. Testing/Tuning with covers off

Item	Description	Product Code
2	ADS–1	0730011
3	XCM–1	4626170
4	PCS–1	0730012
7	JBS–8	0770014
8	RS232 Adapter	4626170
9	JBS–7	0770015
11	DAU–2	0750006
16	Software diskette	0774062
17	Modular T connector	4626134

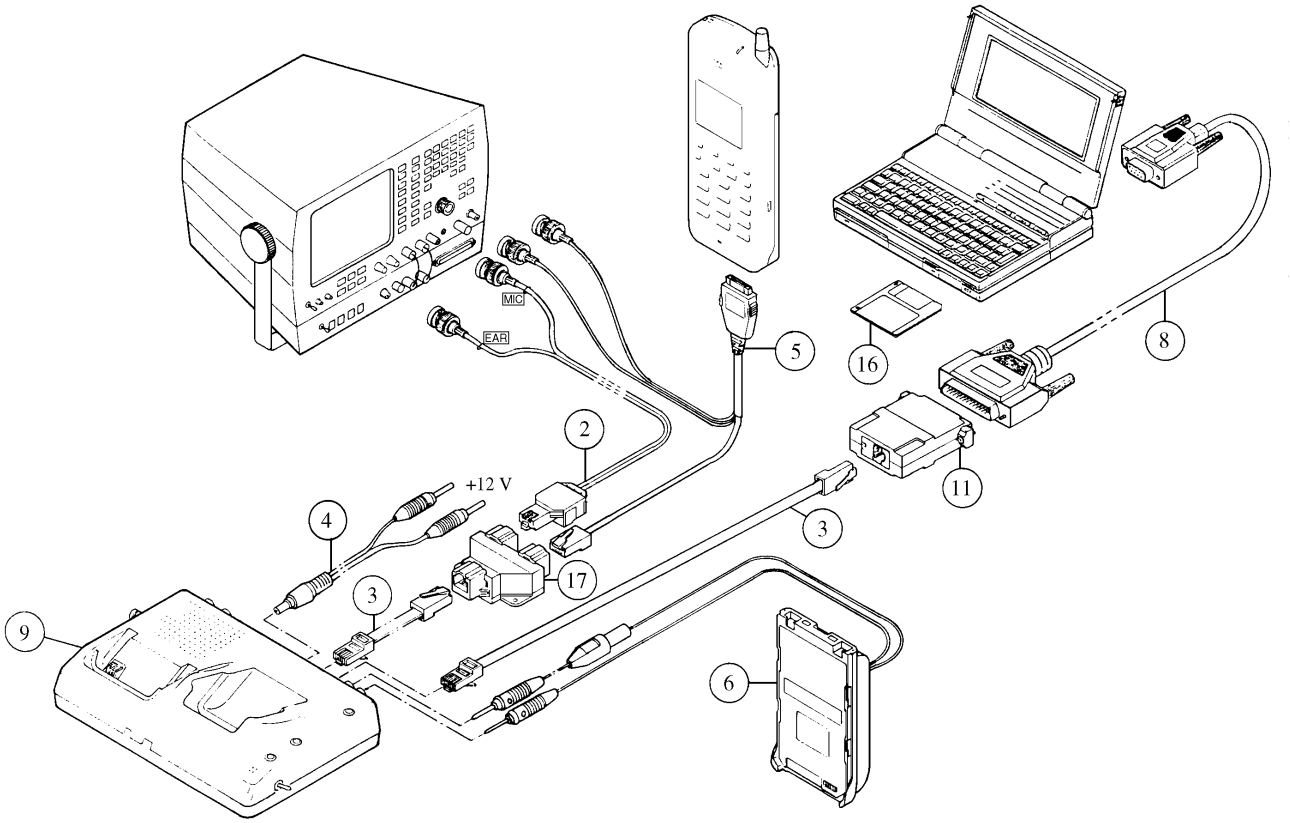


Figure 12. Testing/Tuning with covers on

Item	Description	Product Code
2	ADS–1	0730011
3	XCM–1	4626170
4	PCS–1	0730012
5	SCS–1	0770010
6	BTS–4	0770009
8	RS232 Adapter	4626170
9	JBS–7	0770015
11	DAU–2	0750006
16	SWSA881	0774062
17	Modular T connector	4626134

Main Menu

The main menu bar below appears when HD881 initializes, adding the following new categories, *Tuning,Testing, Software, Dealer* and *Help. Product* and *Configure* have also changed.

Product

The following items are added to this menu when HD881 is recognized:

Initialize

Allows the phone to be set up in either *Normal*, *Local or Minimum* mode.

Normal Mode

When selecting *Norma*l mode, the phone tries to synchronize into the base station and a message displays this. This is ”normal” operation mode of the phone.

Local Mode

When *Local* mode is selected the phone is suspended from normal operation and set to a special mode allowing Tuning and Testing to be done.

Minimum Mode

When *Minimum* mode is selected the phone is deactivated and only the MCU will communicate with the PC using the Service Software. This mode is used for Flash software changes.

Configure

Channel Settings

This configures the channel number, for a product type, to be *Low, Mid, High* in order to allow losses to be configured for manual testing.

Tuning Steps of Radio Unit

The Service software program places the phone into the Locals mode, in which the phone can be outwardly controlled via the M2BUS interface.

The tuning values of the phone reside on the EEPROM. Before tuning, these values are read by the Service software and the user can change these values with tuning functions.

Note: *During tuning, keep the following in mind:*

- Take care not to damage sensitive measuring instruments with excessive RF power.
- Carry out all tuning steps in the shortest possible time to avoid excessive heating of RF units.
- Perform all tuning steps in the order presented.
- Never try to mask a fault by tuning it out!

Accuracy of the Equipment During Measurement

- Power supply 1; nominal voltage 12 ±0.5 V current cap. min. 1.5 A for service box (JBS–7).
- Power supply 2 ;nominal voltage 6.0 ±0.1 V, current cap. min. 1.5 A.
- Modulation analyzer power level resolution 0.1 dB, accuracy ±0.5 dB. Frequency counter accuracy 0.1 ppm ⟨±80 Hz).
- RF generator; frequency res. 10 Hz amplitude res. 0.1 dB frequency stab. ±0.25 ppm.
- Spectrum analyzer; dynamic range 70 dB, accuracy ±1 dB (For power level measurement accuracy ±0.5 dB).

General

Caution: *The phone can not be Tuned properly if connected to the FPS–3C Flash Programming Box. Please use only one of the setup configurations listed in the "Dealer Setups" section of the NHD–4NX Service Manual.*

Battery Voltage Adjustment

A reference value for the battery is calibrated by using an accurate 6.0 V supply.

Calibration of the A/D converter channels:

- Using the JBS–7 service jig, replace the standard battery of the phone with the dummy battery BTS–4.
- Apply +6.0 V to dummy battery.
- Select " Tuning – Battery voltage".
- The Program reads the 6 Volts applied and displays the corresponding A/D reading fed to the phone via the VBATT line.
- Store this new value to the phone by pressing "Tune". Then Exit

Charge Voltage Adjustment

A reference value for charge voltage is set by using an accurate 6.0 V supply.

Calibration of the charge voltage:

- Using the JBS–7 service jig, replace the standard battery of the phone with the dummy battery BTS–4.
- Apply +6 V to VCHARGE line.
- Select "Tuning – Charge voltage ".
- The Program reads 6 V, A/D reading fed to phone VCHARGE line.
- Store this new value to the phone by pressing "Tune". Then Exit

RF Temperature Adjustment

This adjustment should be made with the phone at room temperature. It is important that all RF transmitter tunings be done as quickly as possible. This is to ensure that this reference temperature adjustment is within limits required for temperature compensation.

Calibration of the RF Temperature:

- Using the JBS–7 service jig, replace the standard battery of the phone with the dummy battery BTS–4.
- Apply +6 V to VCHARGE line.
- Select "Tuning – RF Temperature ".
- Press "Tune". The Program reads the internal thermistor value and stores this value to the phone.

AMPS Tuning

Analog Bias Current Tuning

The purpose of this tuning is to optimize transmitter‘s efficiency.

Bias tuning is needed if:

– PLL circuit (N500) is replaced

– Any of the power amplifiers V110, V111, V112, V113 or the duplex filter is replaced

– Any of power amplifier resistors are replaced

This affects only power consumption and thus gain and linearity of power amplifier.

Description of Tuning

This tuning sets the bias current to the CLY–10 (V113) final PA gain stage for AMPS mode operation at output power level 7. The TXB PDM is used to set this bias. The bias is set to provide 100 mA of current to the CLY–10 in this state. This 100 mA current is the amount of current draw above the quiescent state of the phone in AMPS mode, as described in the AMPS Mode Quiescent Current section 3.1. Note that the CLY–10 will draw additional current at higher output AMPS power levels. This is due to self biasing by the drive signal.

Analog bias current tuning steps & equipment:

– Using the JBS–7 service jig, replace the standard battery of the phone with the dummy battery BTS–4.

– Apply +6.0 V to dummy battery.

– Start the service software and go to ”Main” menu.

– Select ” Tuning – Analog Bias Tuning ”

– Measure step1 current consumption from power supply current display and input it to Service software prompt. Then press OK.

– Adjust first analog mode bias current to the target value displayed in tuning dialog by using Arrow keys or PgUp/PgDn keys.

AFC Tuning

This tuning is done to calibrate the VCTCXO oscillator frequency.

This tuning is needed if the VCTCXO (G300), any component of AFC–line or the CDRFI (N700) is changed.

Description of Tuning

This procedure tunes the VCTCXO to 15.36 MHz. The unmodulated AMPS transmitter carrier on channel 384 is used to perform this test. The output carrier is monitored with a spectrum analyzer with a 10 kHz span. The VCTCXO is tuned by adjusting the AFC PDM until the carrier is on frequency at 836.52 MHz within 200 Hz. For standard AFC operation the RX_SLOPE PDM is high, at approximately 3.15 V.

AFC calibration steps & equipment:

– Using the JBS–7 service jig, replace the standard battery of the phone with the dummy battery BTS–4.
– Apply +6.0 V to dummy battery.
– Select ” Tuning – AFC ”
– Connect the modulation (or spectrum) analyzer to antenna connector and measure transmitter frequency. Adjust frequency to 836.52 MHz + – 200Hz with arrow or PgUp/PgDn –keys.
– Press <save & exit> to store value to EEPROM or <cancel> to exit without saving.

Deaf Channel Frequency Tuning

This tuning is done to calibrate the VCTCXO oscillator frequency to adjust for “deaf” or “blocked” AMPS channels.

This tuning is needed if the VCTCXO (G300), any component of AFC–line or the CDRFI (N700) is changed.

Description of Tuning

This is a secondary tuning done on the VCTCXO for a special case involving AMPS channels 184, 440 and 696, known as the Deaf channels. This tuning is performed exactly as it was in the AFC Tuning above, but now channel 440 is used rather than channel 384. In this case the RX_SLOPE PDM is low at approximately 0.0 V. Again the AFC PDM is adjusted to tune the transmit carrier to within 200 Hz of the center frequency, this time 838.20 MHz. Consult the HD881 Synthesizer Functional Description for more information on the Deaf Channel functionality of the synthesizer.

AFC calibration steps & equipment:

– Using the JBS–7 service jig, replace the standard battery of the phone with the dummy battery BTS–4.
– Apply +6.0 V to dummy battery.
– Select ” Tuning – Deaf Channel Frequency”
– Connect the modulation (or spectrum) analyzer to antenna connector and measure transmitter frequency. Adjust frequency to 838.20 MHz + – 200Hz with arrow or PgUp/PgDn –keys.
– Press <save & exit> to store value to EEPROM or <Close> to exit without saving.

TX Output Power

This adjustment loads the power levels of the phone transmitter into EEPROM. When doing this, a power meter must be used.

This tuning is needed if CDRFI (N700), duplex filter, power RF transistors or power control parts are replaced

Description of Tuning

This tuning sets the AMPS transmitter power levels 2–7 to the required power output. To perform this tuning the phone is placed in AMPS Mode and the carrier is turned on. AMPS TX power control on the 2180 is done by adjusting the TXI_REF PDM.

Power levels programming:

– Using the JBS–7 service jig, replace the standard battery of the phone with the dummy battery BTS–4.
– Apply +6.0 V to dummy battery.
– Select ” Tuning – TX power level”
– Connect power meter to antenna via the phone’s bottom connector.
– Adjust the tuning value with the arrow keys (fine tuning) or with PgUp and PgDn–keys (coarse tuning) until the desired output power is reached. Tuning starts from the highest power level.

Note: *There is a little cable loss between the antenna connector and the RF power meter. The total attenuation of 1 meter long RG–58 cable and the service box is about 0.7 dB. Please take this into account.*

Power level	Target Power level values (milliWatts)	Example value A/D converter
2	26.8 dB (479 mW)	143
3	22.8 dB (239.9 mW)	0
4	18.8 dB (95.5 mW)	–40
5	14.8 dB (38.0 mW)	–89
6	10.8 dB (15.1 mW)	–129
7	6.8 dB (6.03 mW)	–161

– Use the <TAB> key to move to tune the next power level.
– Press <Save & exit> to store calculated values to the phone and exit or <Close> to exit without storing.

TX Modulation Index Calibration

This tuning is done to adjust the FM Modulators and the gain of TX–audio path.

This tuning is needed if Codec (N600), or components D1, N500 or D704 is changed.

Description of Tuning

This tuning adjusts the level of FM modulation on the AMPS transmitter. To do this, the Signaling Tone (ST) is turned on and the modulation level on the transmit signal is monitored. The TX_MOD level in the DSP is adjusted in software. This value controls the level of the audio frequency tone leaving the CDRFI pin 25 on route to the VHF synthesizer for modulation. At the CDRFI, pin 25 this line is called DAFOUT. Into the VHF synthesizer it named ANATX. For the ST tone the TX_MOD level is adjusted until the FM modulation is 8 kHz +/– 0.2 kHz

FM Modulation adjustment:

- Using the JBS–7 service jig, replace the standard battery of the phone with the dummy battery BTS–4.
- Apply +6.0 V to dummy battery.
- Select ” Tuning – TX Modulation Index”
- Connect modulation analyzer to antenna connector. Use 20 kHz low pass filter.
- Use PgUp/PgDn keys to adjust to 8.0 kHz +/– 100 Hz. (ST signal is switched ON)
- Press <Save & Exit> to store values to the phone and exit or <Cancel> to exit without saving.

RSSI

This step consist of tuning the analog mode reference value for the receiver signal strength meter.

This tuning is needed if FM detector (D1); any parts of RX–chain; duplex filter or saw filter has been changed

Note: *Take into account any cable loss.*

Description of Tuning

This tuning records the RSSI values for low and high power received signals. This is done by feeding a –95 dBm signal into the AMPS receiver at channel 384 with modulation of 8 kHz FM, 1 kHz audio. The RSSI voltage generated by the AMPS receiver IC (D1) routes to the MCU, pin 58. The MCU reads the RSSI value resulting from its onboard A/D converter. For the –65 dBm input signal this digital value is stored in EEPROM as RSSI_HI. This process is repeated for a –65 dBm modulated input signal, and the stored value is termed RSSI_LO. The RSSI values read by the MCU are 10 bit numbers.

Analog RSSI level tuning steps:

- Using the JBS–7 service jig, replace the standard battery of the phone with the dummy battery BTS–4.
- Apply +6.0 V to dummy battery.
- Connect signal generator to antenna connector at 881.52 MHz (channel 384) using modulating frequency 1.0 kHz with a deviation of 8.0 kHz and level of –95 dBm.
- Select ” Tuning – RSSI”.
- The program reads the reference value stored on phone together with the reference value read from A/D converter.
- A/D converter value should be between 0 – 255.
- Press <Tune> to store values to the phone and exit or <Cancel> to exit without storing.
- Connect signal generator to antenna connector at 881.52 MHz (channel 384) using modulating frequency 1.0 kHz with a deviation of 8.0 kHz and level of –65 dBm.
- A/D converter value should be between 0 – 255.
- Press <Tune> to store values to the phone and exit or <Cancel> to exit without storing.

RX Audio Gain

The purpose of this tuning operation is to calibrate the gain of audio path.

This tuning is needed if FM detector (D1) including surrounding components of FM detector or Audio Codec (N600) is changed

Description of Tuning

This tuning adjusts ratio of output audio gain vs. the level of received FM frequency deviation. A –80 dBm signal with 2.9 kHz FM, 1 kHz audio is fed into the phone on channel 384 (881.52 MHz). The received, demodulated output audio level is read from the ear piece at the output of the bottom connector. The rxgaina value sets the amount of audio gain. This value is tuned until the output audio level at the ear piece is 78 mVac , +/– 2 mV.

Demodulation adjustment:

– Using the JBS–7 service jig, replace the standard battery of the phone with the dummy battery BTS–4.
– Apply +6.0 V to dummy battery.
– Select ” Tuning – RX Audio Gain”
– Apply modulated test signal (ch. 384, RX frequency 881.52 MHz, modulation 1 kHz with 2.9 kHz deviation and RF level –80 dBm) to antenna connector.
– Adjust tuning value with arrow keys (fine tuning) or with PgUp and PgDn–keys (coarse tuning) until measured EAR level is 79 mVrms +/– 1mV.
– Press <Save & Exit> to store values to the phone and exit or <Cancel> to exit without storing.

CDMA Tuning

RX Offset Tuning – (RX/TX)

The purpose of this tuning operation is to calibrate the mid point of the CDMA Receiver's dynamic range.

This tuning is needed if the duplexor, CDGACR (N1) or BBFIL (N2) is changed.

Definition of Tuning

The purpose of this tuning is to center the dynamic range of the RxDac to correspond to the midpoint of the dynamic range of the CDMA receiver. A –65 dBm 881.62 MHz signal is fed into the phone. –65 dBm is the midpoint of the –25 to –105 dynamic range of the CDMA receiver. The RX_OFFSET PDM is adjusted until the RxDac is at its midpoint of approximately 200H. The RX/TX designation on the name of this tuning implies that both the receiver and transmitter are functioning when this tuning occurs. A separate tuning must occur when the transmitter is not on, hence the reason for the RX_OFFSET (RX) tuning.

TX Offset calibration steps & equipment:

- Using the JBS–7 service jig, replace the standard battery of the phone with the dummy battery BTS–4.
- Apply +6.0 V to dummy battery.
- Connect the modulation (or spectrum) analyzer to antenna connector.
- Select " Tuning – Rx Gain Offset"
- Adjust the Rx Offset Value with arrow or PgUp/PgDn –keys until the current RxDAC register value is with the target limits.
- Press <save & exit> to store value to EEPROM or <cancel> to exit without saving.

RX Offset Tuning – (RX)

The purpose of this tuning operation is to calibrate the center the dynamic range of the RxDAC to correspond to the midpoint of the dynamic range of the CDMA receiver.

This tuning is needed if the duplexor, CDGACR (N1) or BBFIL (N2) is changed.

Definition of Tuning

The purpose of this tuning is to center the dynamic range of the RxDAC to correspond to the midpoint of the dynamic range of the CDMA receiver. A –65 dBm 881.62 MHz signal is fed into the phone. –65 dBm is the midpoint of the –25 to –105 dynamic range of the CDMA receiver. The RX_OFFSET PDM is adjusted until the RxDAC is at its midpoint of approximately 200H. The RX designation on the name of this tuning implies that the CDMA receiver is functioning when this tuning occurs, but not the transmitter. A separate tuning must occur when the transmitter is on as well, hence the reason for the RX_OFFSET (RX/TX) tuning found above.

TX Offset calibration steps & equipment:

- Using the JBS–7 service jig, replace the standard battery of the phone with the dummy battery BTS–4.
- Apply +6.0 V to dummy battery.
- Connect the modulation (or spectrum) analyzer to antenna connector.
- Select ” Tuning – Rx Gain Offset Rx”
- Adjust the Rx Offset Rx Value with arrow or PgUp/PgDn –keys until the current RxDAC register value is with the target limits.
- Press <save & exit> to store value to EEPROM or <cancel> to exit without saving.

Rx Slope

The purpose of this tuning operation is to calibrate the linear relationship, or slope, between a change in the received power by the CDMA receiver.

This tuning is needed if the duplexor, CDGACR (N1), CDSB (D704), CDRFI (N700) or BBFIL (N2) is changed.

Definition of Tuning

This tuning determines the linear relationship, or slope, between a change in the received power by the CDMA receiver. To do this a CW signal is fed into the CDMA receiver. The initial CW signal power is stored as BPOW1. Next, the CW signal power is incremented until the RxCtr changes by 256 steps. The CW signal power required to do this is recorded as BPOW2. The difference between BPOW1 and BPOW2 should be approximately 32 dB. From this data the RX Slope is determined. It is then manipulated mathematically so that the RX Slope equals “1”. When it does, a one bit change in the RxCtr will result in a 1/8 dB change in receiver gain. The RX/TX designator on the name of this tuning implies that the transmitter is on when this tuning is performed. A separate tuning must occur when the transmitter is not on, hence the reason for the RX_Slope (RX) tuning.

Rx Slope calibration steps & equipment:

- Using the JBS–7 service jig, replace the standard battery of the phone with the dummy battery BTS–4.
- Apply +6.0 V to dummy battery.
- Select ” Tuning – Rx Slope”
- Set up the signal generator as requested and press the step 1 key.
- Change signal generator set up as requested and press the step 2 key.
- Press <save & exit> to store value to EEPROM or <cancel> to exit without saving.

Rx Slope Rx

The purpose of this tuning operation is to calibrate the linear relationship, or slope, between a change in the received power by the CDMA receiver.

This tuning is needed if the duplexor, CDGACR (N1), CDSB (D704), CDRFI (N700) or BBFIL (N2) is changed.

Definition of Tuning

This tuning determines the linear relationship, or slope, between a change in the received power by the CDMA receiver and a change in the RxCtr register value in the CDSB ASIC. To do this a CW signal is fed into the CDMA receiver. The initial CW signal power is stored as BPOW1. Next, the CW signal power is incremented until the RxCtr changes by 256 steps. The CW signal power required to do this is recorded as BPOW2. The difference between BPOW1 and BPOW2 should be approximately 32 dB. From this data the RX Slope is determined. It is then manipulated mathematically so that the RX Slope equals “1”. When it does, a one bit change in the RxCtr will result in a 1/8 dB change in receiver gain. The RX/TX designator on the name of this tuning implies that the transmitter is on when this tuning is performed.

Rx Slope Rx calibration steps & equipment:

– Using the JBS–7 service jig, replace the standard battery of the phone with the dummy battery BTS–4.
– Apply +6.0 V to dummy battery.
– Select ” Tuning – Rx Slope Rx”
– Set up the signal generator as requested and press the step 1 key.
– Change signal generator set up as requested and press the step 2 key.
– Press <save & exit> to store value to EEPROM or <cancel> to exit without saving.

Rx Gain Switch Calibration

The purpose of this tuning operation is to calibrate the gain differential of the receiver system with the LNA on and off.

This tuning is needed if the LNA (V12), N701 or N702 is changed

Definition of Tuning

This operation determines the gain differential of the receiver system with the LNA on and off. The CDMA receiver system is then calibrated accordingly. To do this a constant level CW tone is fed into the CDMA receiver. The LNA is turned on and the received signal strength to the CDSB ASIC (D704) is read and stored. This is the also known as the RxCtr value. With the same input signal the LNA is then turned off and the RxCtr is read again. The dB power difference between the two RxCtr values is equivalent to the gain that the LNA provides.

Rx Gain Switch calibration steps & equipment:

- Using the JBS–7 service jig, replace the standard battery of the phone with the dummy battery BTS–4.
- Apply +6.0 V to dummy battery.
- Select ” Tuning – Rx Gain Switch Calibration”
- Set the signal generator as requested and press the tune Key.
- Press <save & exit> to store value to EEPROM or <close> to exit without saving.

CDMA TX Bias Tuning

The purpose of this tuning operation is to calibrate the Power Amplifiers bias current limit.

This tuning is needed if the Power Amplifier (V113) or any transistor in the TX chain (V110 – V112) is changed.

Definition of Tuning

This tuning sets the bias current limits on the CLY–10 (V113) final PA gain stage. Bias current on the CLY–10 is dynamic in CDMA operation. The TXB PDM is used to set this bias. Low power is defined as less than or equal to +10 dBm of output CDMA TX bandpower. For the low power case the bias is set to provide 100 mA of current to the CLY–10. Max Power is defined as greater than or equal to +23 dBm of output CDMA TX bandpower. For the Max Power case the bias is set to provide 250 mA of current to the CLY–10. Between Low and Max Power the bias current ramps up linearly from 100 to 250 mA. These currents described are the amount of current draw above the quiescent state of the phone in CDMA mode. The figure below better describes the TXB Slope.

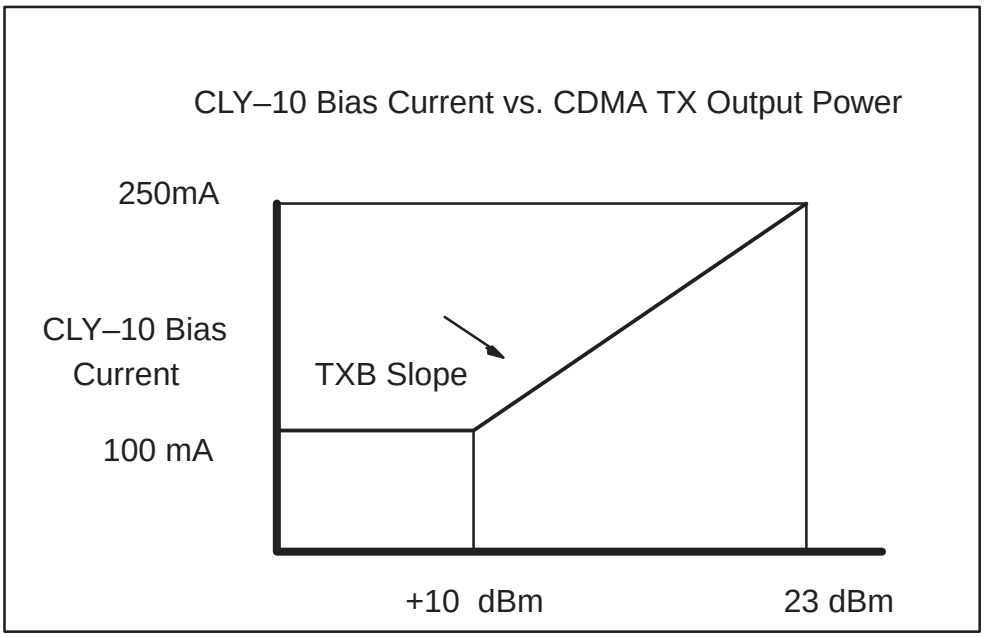


Figure 13. CDMA TX Output power

***Note**: This Tuning may need to be repeated several times to ensure proper calibration. It is recommended that each step be reverified since this tuning step will affect battery performance.*

TX Offset calibration steps & equipment:

- Using the JBS–7 service jig, replace the standard battery of the phone with the dummy battery BTS–4.
- Apply +6.0 V to dummy battery.
- Connect the Current meter in line with the power supply to the phone.
- Connect the modulation (or spectrum) analyzer to antenna connector and measure transmitter power.
- Select ” Tuning – Digital Bias”
- Enter the current draw measured from the current meter into the dialog prompt and press <OK>.
- Use the Up, Dn Keys to adjust the “Present Bias Value” until the Current draw is within 5 mA of the “Target Bias Current”.
- Enter the actual current measurement into the “Actual Current” box.
- Press TAB to highlight the “Present Output Power” box.
- Use the Up, Dn Keys to adjust the “Present Output Power” value until a the measured Transmitter output is within the “Target Output Power” range.
- Enter the actual power measured into the “Actual Power” box.
- Press <save> to store value to EEPROM or <close> to exit without saving.
- Repeat the above process for Step 2 using the associated Target values.

Align TX Gain Limiting Tuning

The purpose of this tuning operation is to calibrate the Maximum Power output in CDMA mode.

This tuning is needed if the Power Amplifier (V113) or surrounding components of is changed .

Definition of Tuning

This tuning sets the upper limit on the output power of the CDMA TX. To do so, the CDMA TX is initially railed high, providing the maximum output power that the phone's software will allow it to produce. This output power is then reduced until it is approximately 24.5 dBm. This is accomplished by decreasing the value of the TXI_REF PDM. The value of TXI_REF PDM determines the TX limit by comparing itself to the TXI voltage generated by the detector. It is important to keep in mind that this 24 dBm value refers to power within the 1.23 MHz CDMA channel band. Thus it is a bandpower measurement, not a peak power measurement.

TX Offset calibration steps & equipment:

– Using the JBS–7 service jig, replace the standard battery of the phone with the dummy battery BTS–4.
– Apply +6.0 V to dummy battery.
– Connect the modulation (or spectrum) analyzer to antenna connector and measure transmitter frequency. Adjust frequency to 838.20 MHz + – 200Hz with arrow or PgUp/PgDn –keys.
– Select " Tuning – TX Maximum Gain"
– Adjust tuning value with arrow keys (fine tuning) or with PgUp and PgDn–keys (coarse tuning) until measured Power level is within the Target value.
– Press <save & exit> to store value to EEPROM or <cancel> to exit without saving.

Aux. AGC Tuning

The purpose of this tuning operation is to calibrate the Automatic Gain Control circuit in CDMA mode.

This tuning is needed if CDCONT (N201), N1, N2, N100 or N700 is changed.

Aux. AGC is an auxiliary transmitter gain control feature implemented to improve the signal to noise ratio of the CDMA TX output. The figures below will assist in the explanation of the Aux. AGC functionality.

The gain of the CDMA transmitter is controlled by two devices, the CDAGCT IC (N100) and the AT–109 variable attenuator (V106). CDMA TX output power is controlled by the CDAGCT IC across the dynamic range of –50 dBm to 15 dBm. The 15 dBm output point is referred to as the Switch Point. Above the Switch Point (15 dBm), the AT–109 variable attenuator controls the output power level. This secondary gain control mechanism is referred to as Auxiliary AGC (Aux. AGC). A more thorough description of Auxiliary AGC is found in the Transmitter Troubleshooting Manual and Functional Description.

Below the Switch Point (less than 15 dBm CDMA TX power) the attenuation of the AT–109 is set to its maximum level of tuned attenuation. Above the Switch Point this attenuation is decreased, thus increasing the overall gain of the CDMA TX chain. The Aux. AGC circuit is tuned to provide a 10 dB dynamic range of attenuation. Without this 10 dB of attenuation in place the output power increases 10 dB above the switch point to approximately 25 dBm. In practice the 25 dBm may not be reached due to the TX Gain Limiting feature. Figure 5.4.1 below depicts this functionality.

The amount of attenuation provided by the AT–109 (V106) is controlled by the voltage VC. VC is a function of the AGC_REF PDM. For minimum attenuation the AUX. AGC PDM voltage is typically 0.75 V, resulting in 3.25 V for VC. For maximum attenuation the AUX. AGC PDM voltage is typically 10.0 mV, resulting in 1.50 V for VC. The Auxiliary AGC can be manually adjusted using the AGC_REF PDM controls found in the Service Software.

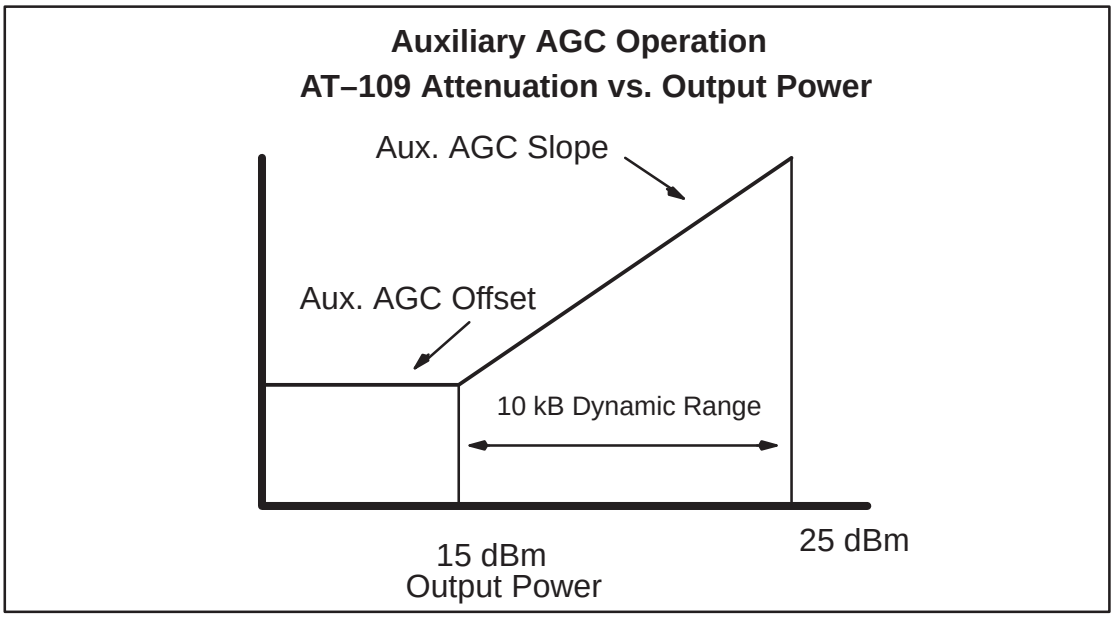


Figure 14. Auxiliary AGC Operation 1

There are three steps in the Aux. AGC tuning to determine the 10 dB dynamic range of attenuation used on the AT–109, as well as the maximum and minimum attenuation points. The Figure below will assist in the description of these three tuning steps.

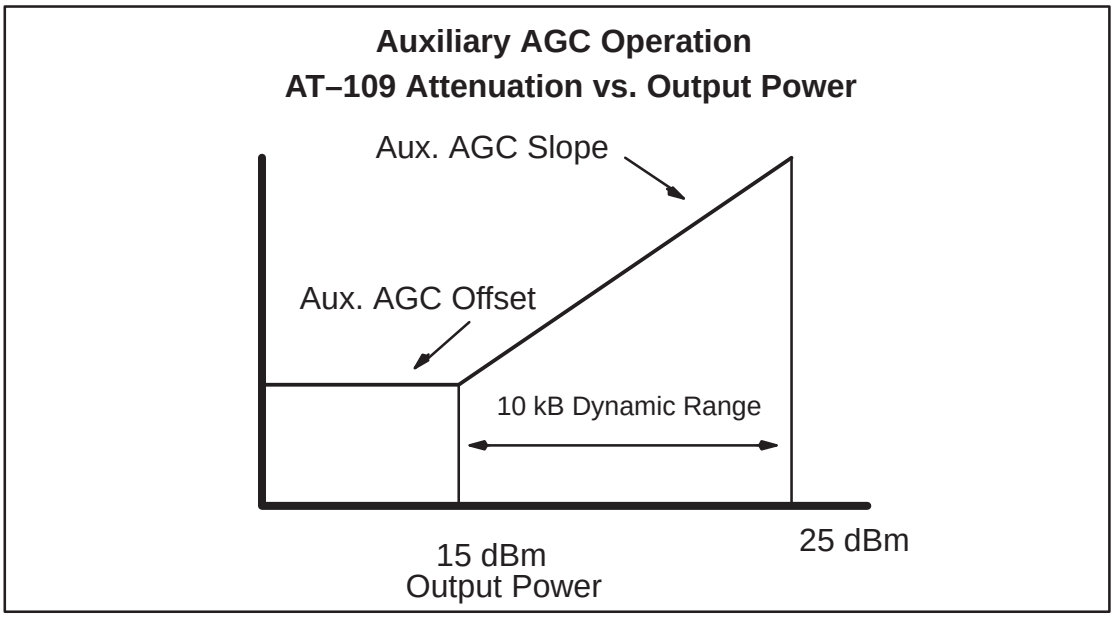


Figure 15. Auxiliary AGC Operation 2

Band Power 1 Tuning (BPOW1)

Description of Tuning

For this step the AT–109 is set to minimum attenuation and the TX_OFFSET PDM is adjusted until the CDMA TX output bandpower is 16 dBm +/– 1.0 dB. This bandpower level is position BPOW1 on Figure 2.2 above.

TX Offset calibration steps & equipment:

– Using the JBS–7 service jig, replace the standard battery of the phone with the dummy battery BTS–4.
– Apply +6.0 V to dummy battery.
– Connect the modulation (or spectrum) analyzer to antenna connector.
– Select ” Tuning – Auxiliary AGC”
– Use the Up, Dn, PgUp or PgDn keys to adjust the BPOW1 power level to the target range.
– Enter the actual measured TX Power into the dialog box and press <Enter>.

Band Power 1 – 2 Tuning (BPOW1 – BPOW2)

Description of Tuning

For this step the AGC_REF PDM is adjusted to provide 5 dB of attenuation from the AT–109. The CDMA TX output bandpower will then be approximately 11 dBm, 5 dB off from the initial 16 dBm set in the BPOW1 step. This bandpower position is referred to as BPOW2. This 5 dB is necessary to move the AT–109 dynamic range off the curved portion of the attenuation response as seen between points BPOW1 and BPOW2.

– Use the Up, Dn, PgUp or PgDn keys to adjust the BPOW2 power level to the target range.
– Enter the actual measured TX Power into the dialog box and press <Enter>.

Band Power 2 –3 Tuning (BPOW2 – BPOW3)

Description of Tuning

For this step the AGC_REF PDM is adjusted to provide an additional 10 dB of attenuation from the AT–109. The CDMA TX output bandpower will then be approximately 1.0 dBm, 10 dB off from the 11 dBm set in the previous tuning step. This bandpower position is referred to as BPOW3. This 10 dB attenuation is the dynamic range that the AT–109 will operate from.

– Use the Up, Dn, PgUp or PgDn keys to adjust the BPOW3 power level to the target range.
– Enter the actual measured TX Power into the dialog box and press <Enter>.
– Press <continue> for the next screen or <cancel> to exit without saving.

Band Power 3 Tuning (BPOW3)

Description of Tuning

This tuning step simply reports the BPOW3 bandpower position tuned in during the previous step. This is the level of attenuation that the AT–109 will maintain when the phone transmitting below the Switch Point (15 dBm) while in CDMA operation power

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– Use the Up, Dn, PgUp or PgDn keys to adjust a reference power level into the target range and press <continue>.

TX Offset Tuning

Definition of Tuning

This tuning adjusts the mid–point of the TxDac register to correspond to –8 dBm of TX output power, the mid–point of the TX output dynamic range.

– Use the Up, Dn, PgUp or PgDn keys to adjust BPOW1 power level into the target range and press <Enter>.

TX Slope Tuning

Definition of Tuning

This tuning determines the linear relationship, or slope, between a change in the output bandpower of the CDMA TX and a change in the TxDac. To do this the CDMA transmitter is turned on and set to an output bandpower corresponding to a TxDac value referred to as TxDac1. The resultant bandpower is read and stored as BPOW1. Next, the TxDac is decremented by a fixed amount that should result in approximately 32 dB less output bandpower than the initial state. This TxDac value is called TxDac2. Again the output bandpower is read, and stored as BPOW2. From this data the TX Slope is determined. It is then manipulated mathematically so that the TX slope equals “1”. When it does, a one bit change in the TxDac will result in a 1/8 dB change in output power. The following graph should help describe the TX Slope concept.

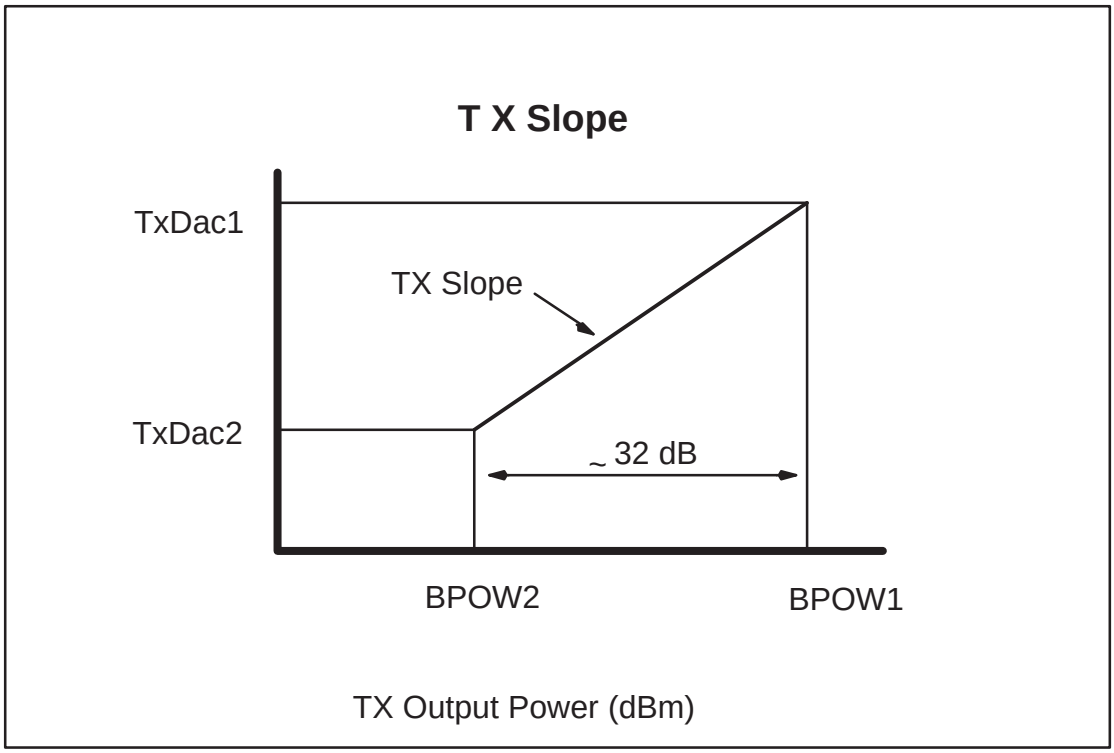


Figure 16. TX Slope

– Manually enter the new TX Power measurement into the BPOW2 location. This value will be approximately minus 32 dB (–32 dB).
– Press <save & exit> to store value to EEPROM or <cancel> to exit without saving.

AGC Tuning

The purpose of this tuning operation is to determines the difference between the received CDMA signal power and the transmit CDMA signal power of the phone when it is in the Open–Loop AGC mode.

This tuning is needed if any component in the receiver or transmitter chain is replaced.

Description of Tuning

This tuning determines the difference between the received CDMA signal power and the transmit CDMA signal power of the phone when it is in the Open–Loop AGC mode. This delta value is better known as CloopRef. To do this a –73 dBm CW tone is fed into the CDMA receiver and the CloopRef value is adjusted in software until the CDMA transmitter output bandpower measures 0.0 dBm.

AGC calibration steps & equipment:

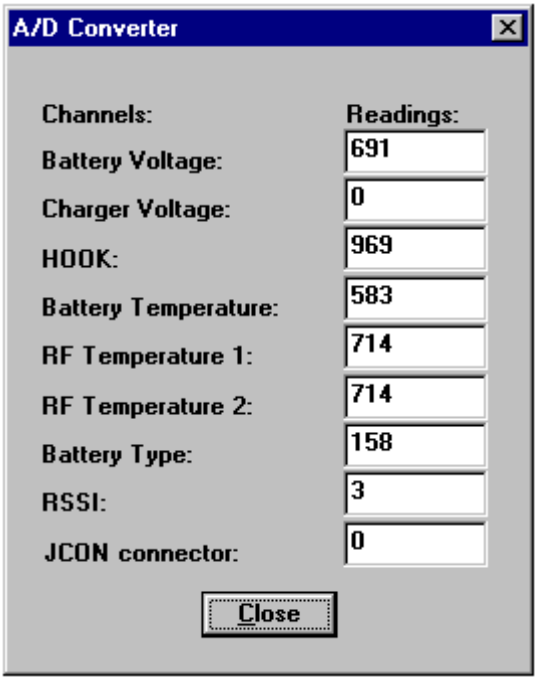
- Using the JBS–7 service jig, replace the standard battery of the phone with the dummy battery BTS–4.
- Apply +6.0 V to dummy battery.
- Select ” Tuning – AGC”
- This tuning is done in duplex mode. Therefore the need to inject a Receive signal, while measuring a transmitt signal is required.
- Inject a signal at the antenna port as described by the tuning screen.
- Adjust the output power to obtain the specified target level.
- Press <save & exit> to store value to EEPROM or <cancel> to exit without saving.

Testing

Self Tests

This option runs the phone's self test sequences and reports any processor visible faults. The self tests provide an effective initial test for a faulty phone.

ADC Readings

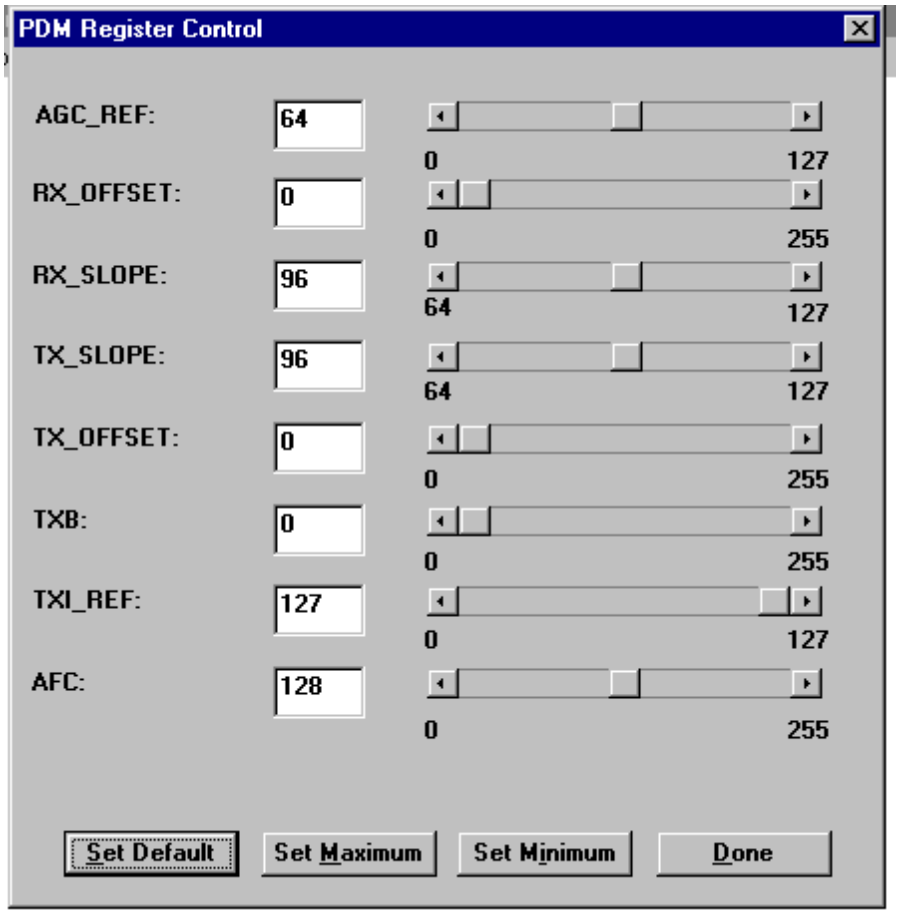


This option allows the phone's ADC readings to be displayed. The readings are updated every few seconds. There may be some delay before the mouse or keyboard responds while running this test.

Pulse Division Modulator (PDM) Control

This test screen is to allow control of each PDM separately. The tests in this section will use the PDM controls from this screen during their execution.

PDM Register Control

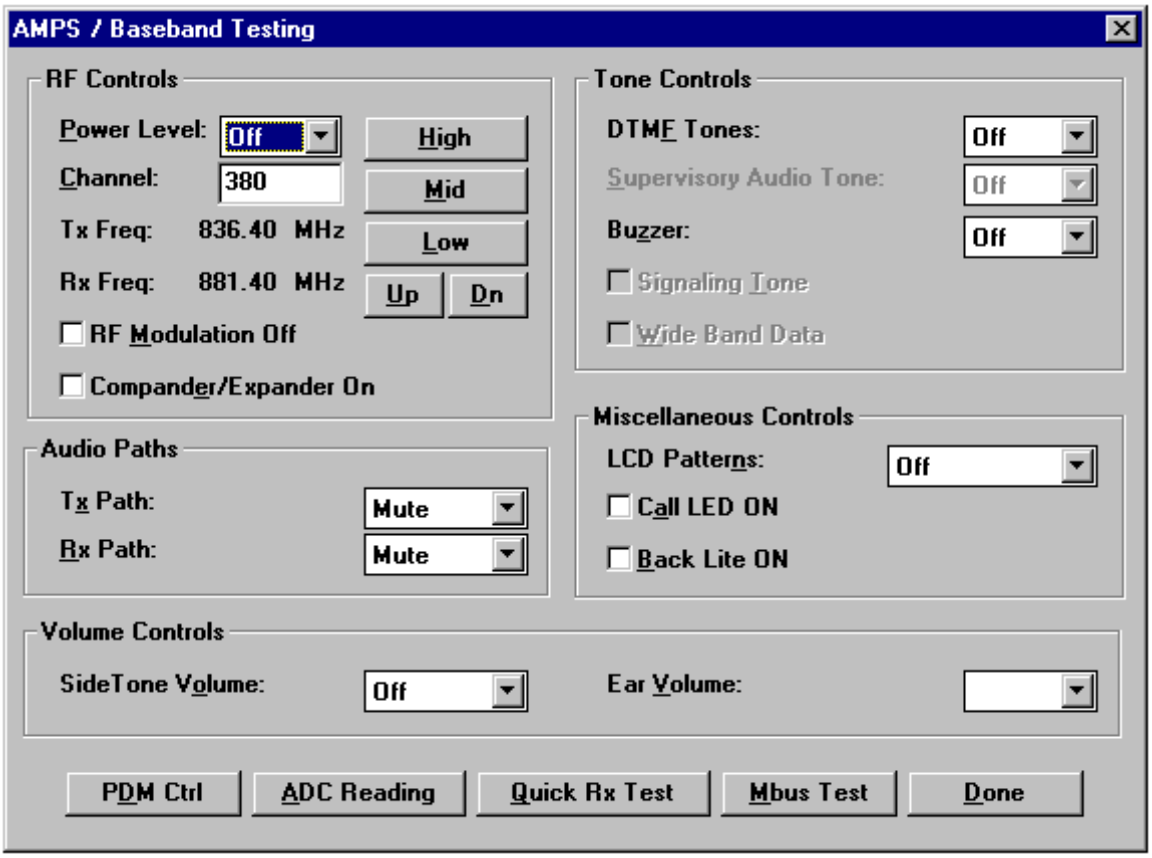


KEYS:

- **<Set Default>** – Sets all PDMs to there default values.
- **<Set Maximum>** – Sets all PDMs to there Maximum values.
- **<Set Minimum>** – Sets all PDMs to there Minimum values.

AMPS / BaseBand Test Screen

This screen is used when testing and troubleshooting the phone in AMPS mode. Below is an example screen.



Keys:

High – Sets the AMPS channel to the Highest Frequency according to the Frequency planning set in the “configure” menu.

Mid – Sets the AMPS channel to the Middle Frequency according to the Frequency planning set in the “configure” menu.

Low – Sets the AMPS channel to the Lowest Frequency according to the Frequency planning set in the “configure” menu.

Up – Increments the channel selection by one.

Dn – Decrements the channel selection by one.

PDM Ctrl – Opens the PDM Control Screen.

ADC Reading – Opens the ADC reading screen.

Quick RX Test – Opens the Quick Receiver test screen.

Mbus Test – Tests the communication between the phone and the computer.

Close – Exits the current screen.

RF Controls:

Power Level – Turns the transmitter on/off and sets power levels.

Channel – Changes the AMPS channel of the phone.

RF Modulation Off – Turns on/off RF modulation to the antenna port.

Compander On– Turns on/off the Compressor and Expander.

Views:

TX Freq. – Displays the current Transmit Frequency.

RX Freq. – Displays the current Receiver Frequency.

Audio Paths:

TX Path: – Allows the user to control the TX Audio path (options: Mute, Ear, External Ear).

RX Path: – Allows the user to control the Rx Audio path (options: Mute, Ear, External Ear).

Volume Controls:

Allows the user to control the volume level of the phone.

Tone Controls:

Allows computer control of DTMF tones, Supervisory Audio Tone (SAT), Signaling Tone (ST), Wide Band Data (WBD), and Buzzer functions.

Miscellaneous Controls:

Allows control of LCD patterns, Call LED and back light.

AMPS Testing

AFC Tuning Functionality Test

Manual Test

To manually verify this functionality of the phone, complete the AFC tuning procedure found in the Service Software, or perform the following steps:

1. Place the phone in AMPS Troubleshooting Mode

2. Monitor the TX signal with a spectrum analyzer set to the following parameters:

Frequency	836.52 MHz
Span	10 kHz (smaller if feasible)
Amplitude	20 dBm
Peak Search	ON
(Signal Track)	

3. Adjust the AFC PDM until the signal is within 200 Hz of 836.52 MHz.

Troubleshooting

If this tuning fails there is most likely either a transmitter or synthesizer failure. Consult both the Synthesizer and Transmitter Troubleshooting sections of the Service Manual and Functional Descriptions for information and tests that can be performed to determine the cause of the fault.

AFC – Deaf Channel Tuning Functionality Test

Manual Test

To manually verify this functionality of the phone, complete the AFC – Deaf Channel tuning procedure found in the Service Software, or perform the following steps:

1. Place the phone in AMPS/Baseband test screen.
2. Turn on the AMPS TX to power level 7.
3. Set the channel to 440.

4.Monitor the TX signal with a spectrum analyzer set to the following parameters:

Frequency	838.20 MHz
Span	10 kHz (smaller if feasible)
Amplitude	20 dBm
Peak Search	ON
(Signal Track)	

5. Adjust the AFC PDM until the signal is within 200 Hz of 838.20 MHz.

Troubleshooting

If this tuning fails there is most likely either a transmitter or synthesizer failure. Consult both the Synthesizer and Transmitter Troubleshooting Manual and Functional Descriptions for information and tests that can be performed to determine the cause of the fault. If this tuning fails, and yet the standard AFC Tuning has passed, then it is likely that there is a fault with RX_SLOPE PDM.

AMPS TX Power Level Tuning Functionality Test

Manual Test

To manually verify this functionality of the phone, perform the AMPS TX Power Level tuning procedure found in the Service Software, or perform the following steps:

1. Place the phone in AMPS Troubleshooting Mode

2. Monitor the TX signal with a spectrum analyzer set to the following parameters:

Frequency	836.52 MHz
Span	1 MHz (smaller if feasible)
Amplitude	30 dBm

3. Adjust the TXI_REF PDM value until the signal falls into the appropriate range of output power for the corresponding power level. The table below details the tuning range for each power level.

AMPS Power Level	Output Power Tuning Range (dBm)
0–2	24 – 30
3	20 – 26
4	16 – 22
5	12 – 18
6	8 – 14
7	4 – 10

Troubleshooting

In the event of a failure, naturally the transmitter might be suspect. It would be advisable to consult the 2180 Transmitter Troubleshooting Manual and Functional Description for suggestions on tests that would verify the functionality of the TX module. Verify the synthesizer functionality as well.

AMPS TX Bias Tuning Functionality Test

Manual Test

To verify this tuning manually, perform the AMPS TX Bias tuning procedure in the Service Software, or perform the following steps:

1. Initiate the AMPS Troubleshooting Mode from the Service Software

2. Set the TXB PDM to 128. This will provide minimum bias to the CLY–10 (V113).

3. Set the TXI_REF PDM to 128 decimal. This provides minimum gain to the TX chain.

4. Record the total current draw of the phone. The phone should draw approximately 250 mA. This is the AMPS Mode Quiescent current

5. Set the AMPS TX power level to 7

6. Increase the TXB PDM until the total current draw from the phone is 100 mA above the quiescent level recorded in step 4.

Troubleshooting

Any faulty IC or component that would cause excess current to be drawn from the power supply could cause a failure of this test. If in fact there is a faulty device or component of significantly wrong value, it will cause failures in additional tests. It is recommended that more tests and tunings be performed to assist in locating the exact problem. An inability to bring either the TXB or TXI_REF PDM voltages to the appropriate levels could also cause a failure.

RSSI Tuning Functionality Test

Manual Test

To manually verify this functionality of the phone perform the RSSI tuning from the Service Software. Another option is to perform the following steps:

1. Input a signal with the following characteristics for either the Hi or Lo received power scenario.

Amplitude Hi	– 65 dBm (at the Test Point)
Amplitude Lo	– 95 dBm (at the Test Point)
FM deviation	8.0 kHz
Audio frequency	1.0 kHz

2. Initiate AMPS Troubleshooting Mode

3. Perform the AMPS RX Quick Test from The AMPS test menu, or read the RSSI value from the ADC reader.

4. The RSSI values read should fall into the ranges stated below:

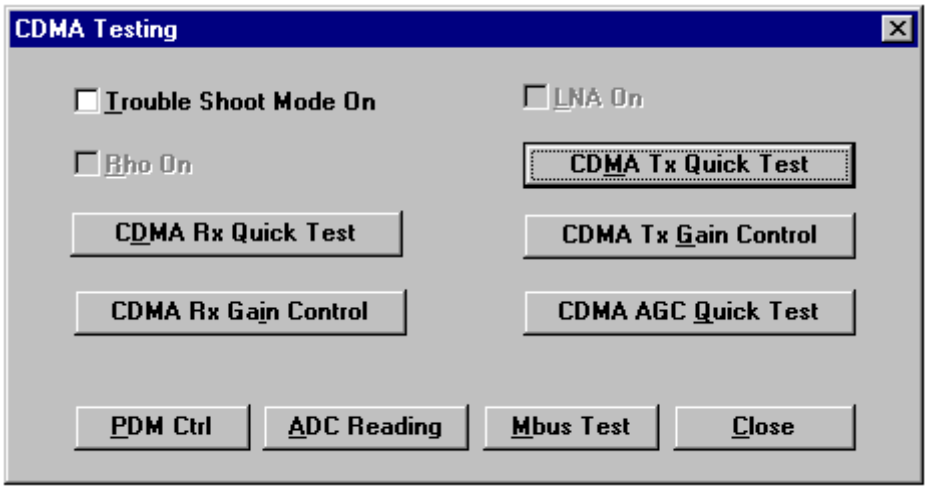
RX Power Condition	RSSI Range
Lo	320 – 520
Hi	520 – 800

Troubleshooting

For this tuning to occur the AMPS receiver must be functioning properly. The MCU must operate as well. The RSSI line from the AMPS receiver IC to the MCU pin 58 must be in tact, thus R759, C13 and C747 should be verified. Consult the 2180 Receiver Troubleshooting Manual for further information and suggestions on troubleshooting AMPS RX faults.

CDMA Testing

This screen is used when testing and troubleshooting the phone in CDMA mode. Below is an example screen.



Keys:

PDM Ctrl – Opens the PDM Control Screen.

ADC Reading – Opens the ADC reading screen.

Quick RX Test – Opens the Quick Receiver test screen.

Mbus Test – Tests the communication between the phone and the computer.

Close – Exits the current screen.

RHO on:

RHO on – turns the CDMA transmitter on/off.

LNA on:

LNA on – turns the CDMA receiver's Low Noise Amplifier on/off.

Troubleshooting mode on:

Troubleshooting Mode on – will set the phone into CDMA mode for technical troubleshooting. This mode is the Local mode for CDMA.

CDMA TX Bias Tuing Functionality Test

Manual Test

To verify this functionality manually, complete the CDMA TX Bias tuning in the Service Software, or perform the following steps:

1. Initiate the CDMA TX Manual Gain controls from the CDMA Test menu located in the Service Software.

2. Set the CDMA TX Gain to minimum. There should be less than –30 dBm of CDMA output band power.

3. Set the TXB PDM to 128 decimal. This will provide minimum bias to the CLY–10 (V113).

4. Read the total current draw of the phone. The phone should draw between 380 and 480 mA, generally about 430 mA. Record this current value as the CDMA Mode Quiescent Current.

5. Initiate the CDMA Troubleshooting Mode from the Test menu of the Service Software.

6. Using the PDM controls Adjust the TX_OFFSET PDM until the output bandpower is –8 dBm.

7. Again use the CDMA TX Manual Gain controls located in the CDMA tests selection of the Test menu.

8. Use this control to achieve approximately 10 dBm of CDMA TX output bandpower.

9. From the PDM controls, adjust the TXB PDM until the total current draw of the phone is 100 mA greater than the CDMA Mode Quiescent Current, determined in step 4. Accomplishing this, verifies Low CDMA TX Power Bias.

10. Repeat steps 3 – 5, but for 23 dBm of CDMA TX output bandpower, and 250 mA of current over the CDMA Mode Quiescent Current, determined in step 4. Accomplishing this verifies Max CDMA TX Power Bias.

Troubleshooting

A failure of this test could be attributed to a number of things. Foremost, both the transmitter and the synthesizer have to be functional. The TXB PDM is adjusted throughout this tuning, as is the TX Offset PDM. Ensure their operation. The negative voltage generator N200 and the VTXS supply should also be inspected for proper operation. If these tunings is unable to achieve the minimum amount of bias currents there may be a faulty, misplaced or wrong value component in the bias circuitry supporting the CLY–10.

TX Gain Limiting Tuning Functionality Test

Manual Test

The CDMA TX Gain Limiting functionality can be verified by performing the TX Gain Limiting tuning procedure found in the tuning menu of the Service Software. Another option is to perform the steps below:

1. Initiate the CDMA TX Manual Gain controls from the CDMA Test menu located in the Service Software.

2. Set the CDMA TX Gain to maximum.

3. From the PDM controls, adjust the TXI_REF PDM to 127 decimal. The phone should achieve approximately 27 dBm of CDMA output bandpower.

4. Adjust the TXI_REF PDM until the CDMA TX output bandpower is approximately 24.5 dBm. If this can be accomplished, the TX Gain Limiting functionality has been verified.

Troubleshooting

A failure of this test might result from a faulty transmitter, or problems within the CDMA TX gain control circuitry. The operation of the CDCONT should be checked, as should the TXI_REF PDM, and the TXI voltage. If the transmitter has lost any gain, this test will most likely fail.

Aux. AGC Tuning Functionality Test

Manual Test

Auxiliary AGC functionality can be verified by performing the Aux. AGC tuning from the Service Software. Another method would be to perform the manual verification steps described below.

1. Maximize the CDMA TX output bandpower by initiating the CDMA Troubleshooting Mode.

2. From the PDM controls, adjust the AGC_REF PDM to 0. This sets the AT–109 to minimum attenuation.

3. Next adjust the TX_OFFSET PDM until the CDMA TX output bandpower is approximately 16 dBm. This verifies the BPOW1 step

4. Adjust the AGC_REF PDM to provide the 5 dB of attenuation, bring the output bandpower to approximately 11.0 dBm. This verifies the next step BPOW1 – BPOW2.

5. Adjust the AGC_REF PDM to provide an additional 10 dB of attenuation, bring the output bandpower to approximately 1.0 dBm. If the additional 10 dB of attenuation is achieved, the third step BPOW2 – BPOW3 is verified. The final 1.0 dBm bandpower is BPOW3.

Troubleshooting

For this step to occur the CDMA transmitter must be functioning, at least enough to achieve 16 dBm of output. The TX_OFFSET and AGC_REF PDMs must work, as well as the AT–109 attenuator. Consult the Service Manual *Transmitter Troubleshooting section and Functional Description* for further information and tests.

LNA Gain Calibration Functionality Test

Manual Test

The LNA Gain Calibration process can be verified by performing the associated procedure found in the tuning menu of the Service Software. It can also be verified manually by performing the following steps:

1. Initiate the CDMA RX Quick Test from the test menu of the Service Software

2. Into the CDMA RX feed a –65 dBm CW signal at 881.62 MHz

3.Turn the LNA on from this window

4. Read the received power to the CDSB ASIC, the RxCtr, by hitting the “Test” button. Record this value.

5. Turn the LNA off

6. Again read the received power to the CDSB ASIC, the RxCtr, by hitting the “Test” button. Record this value.

7. If the LNA is operating correctly the difference between the two recorded values will fall between 120 and 160.

Troubleshooting

Fault with this calibration obviously points suspicion to the LNA functionality. The CDMA RX may also be at fault. Also inspect the RF switches N701 and N702 as well as the resistive attenuator located between them. The Service Manual Receiver Troubleshooting section and Functional Description will provide further information and test suggestions to troubleshoot this fault.

CDMA TX Spurious Check

Definition of Test

This test reads spurious emissions levels of the CDMA Transmitter +/– 900 kHz from the center of the channel. For this test the phone is transmitting at its maximum level in CDMA mode. This test can be performed manually with a spectrum analyzer. To do this feed the 2180 RF output into the spectrum analyzer and set the CDMA TX output to maximum. Service Software rails the CDMA TX to maximum for the CDMA TX Quick Test. I recommend using it to put the phone into the proper mode. Use the averaging functionality of the spectrum analyzer to get readings of better precision. Set a marker + 30 kHz off the center frequency of the transmit signal. Set another marker + 900 kHz off the center frequency. The delta between them should be at least 26 dB. This should also be done for – 30 and –900 kHz off center.

Manual Verification

Spurious emissions of the CDMA transmitter can be read manual using a spectrum analyzer. To do so perform the following steps:

1. Feed the RF output of the phone into the spectrum analyzer.

2. Set the CDMA TX output power to maximum using the manual TX gain controls. The Service Software also rails the CDMA TX to maximum for the CDMA TX Quick Test.

3. Set the Resolution Bandwidth of the spectrum analyzer to 30 kHz. Use the averaging functionality of the spectrum analyzer to get readings of better precision.

4. Set a marker + 30 kHz off the center frequency of the transmit signal.

5. Set another marker + 900 kHz off the center frequency.

6. The delta between the two markers should be at least 26 dB.

7. Repeat this test with markers –30 kHz and –900 kHz off the center frequency.

The resultant value reported from the automated tester is the power difference (delta) in dB between the 30 kHz and 900 kHz frequency offset positions, as described above

Troubleshooting

The CDMA transmitter must be functioning properly to correctly perform this test. The maximum power level of the CDMA TX must be correct, approximately 24 dBm. The operation of the CDAGCT IC (N100) and the AT–I09 attenuator IC (V106) greatly influence the results of this test. Should this test fail, it is suggested that their health and functionality be inspected. The Service Manual Transmitter Troubleshooting section and Functional Description will provide information and tests for the transmitter chain.

LNA Gain Calibration

Definition of Test

This operation determines the gain differential of the receiver system with the LNA on and off. The CDMA receiver system is then calibrated accordingly. To do this a constant level CW tone is fed into the CDMA receiver. The LNA is turned on and the received signal strength to the CDSB ASIC (D704) is read and stored. This is the also known as the RxCtr value. With the same input signal the LNA is then turned off and the RxCtr is read again. The dB power difference between the two RxCtr values is equivalent to the gain that the LNA provides.

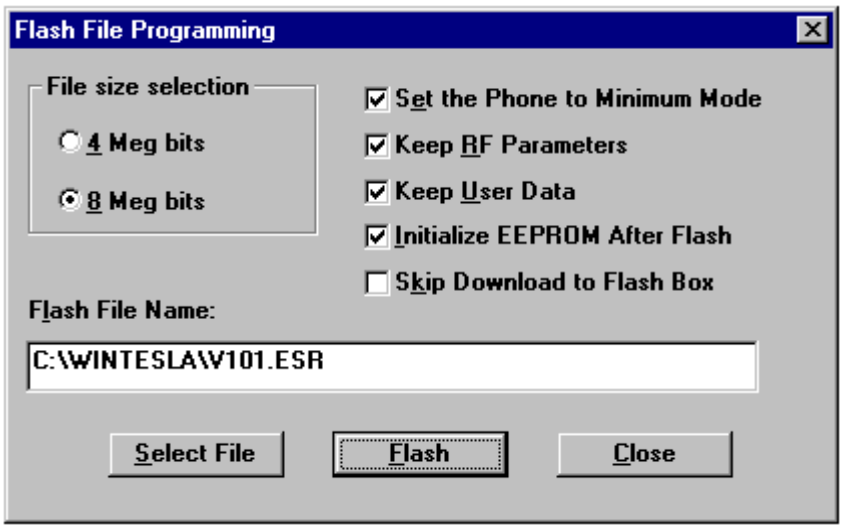
Troubleshooting

Fault with this calibration obviously points suspicion to the LNA functionality. The CDMA RX may also be at fault. The Service Manual Receiver Troubleshooting section and Functional Description will provide further information and test suggestions to troubleshoot this fault.

Software Menu

The Software menu provides the following options:

Flashing



This option allows you Reflash a phone with a new version of flash software, enabling new features to be added and bugs to be removed.

This Reflash option relies on the phone being in full working order and containing the correct HWID and Product Code.

Note: *To successfully update the flash code, the Nokia FPS–3C **MUST** be connected to the PC that is running the WinTesla software. (see mechanical connections in the service manual for details)*

Caution: *The computer that is connected to the FPS–3C Flash box **MUST** have it's parallel port configuration set to **standard AT type**. Otherwise downloading the flash image to the "black box" will fail.*

Reflashing summary:

– Ensure the computers parallel port is configured properly.
– Select "Software – Flash"
– Select the correct flash file to be flashed to the phone.
– Set Flash options in dialog box.
– Press the <Flash> key.

Dialog Options

Each of the options available are described below. It is suggested that only experienced operators change these settings from there default values.

File size selection

Changes the size parameters for the flash file. Default value is 8 Meg bits.

Check box – set phone to minimum mode

Automatically sets the phone to minimum mode. If not set, the operator must “force” the phone to this mode using hardware.

Check box – Keep RF parameters

This option will save the RF parameters before flashing the phone. Once flash updating is complete, these parameters will be stored back to the phone.

Check box – Keep User Data

This option will save user data before flashing the phone. Once flash updating is complete, the user data will be saved back into the phone.

USER DATA SAVED:

- Short Code Memory
- NAM programming information
- Calling Card Numbers
- SID Lists
- System Feature codes
- UI Settings
- Warranty Information

Check box – Initialize EEPROM after Flash

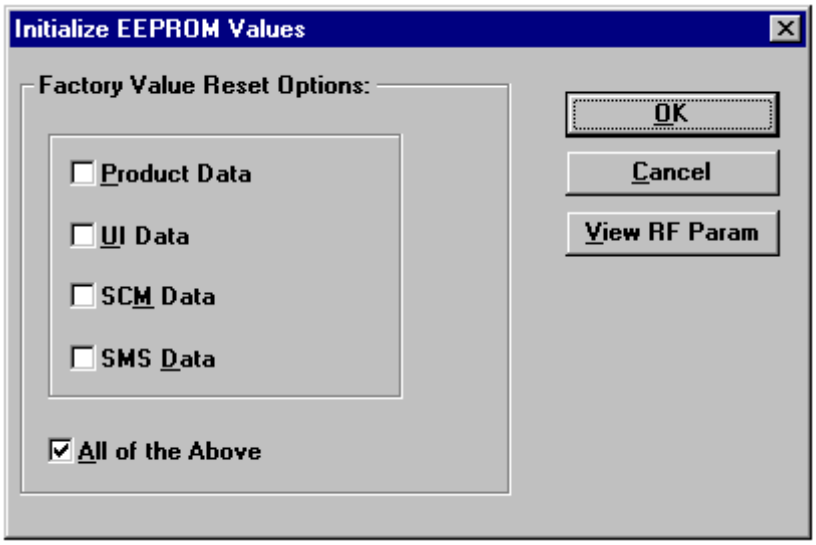
This option will prompt for initialization of the EEPROM after flash updating is complete. It is recommended that the EEPROM be “Initialized“ after flash updating the phone. (*see Initialize EEPROM for more details on this function*)

Check box – Skip download to Flash box

The flash update is done using a two step process. the flash image is downloaded to the flash box in the first step. This takes about 30 to 45 seconds. Then the image is updated on the phone during the second step.

This option is useful if you are updating several phones with the same flash image. After completing the first phone update, checking this option will skip the first step of downloading the flash image to the box again. It is not necessary to download the image again because the box will contain the last image loaded unless a loss of power occurs.

Initialize EEPROM



This option will re–initialize the phone's EEPROM settings.

CAUTION: *All the phone's calibrated (tuned) data will be erased by this option and the phone MUST now be recalibrated.*

Product Data

This option will reset the Product data.

UI Data

This option will reset the user interface data.

SCM Data

This option will reset the short code memory data.

SMS Data

This option will reset the short messaging services data.

All of the above

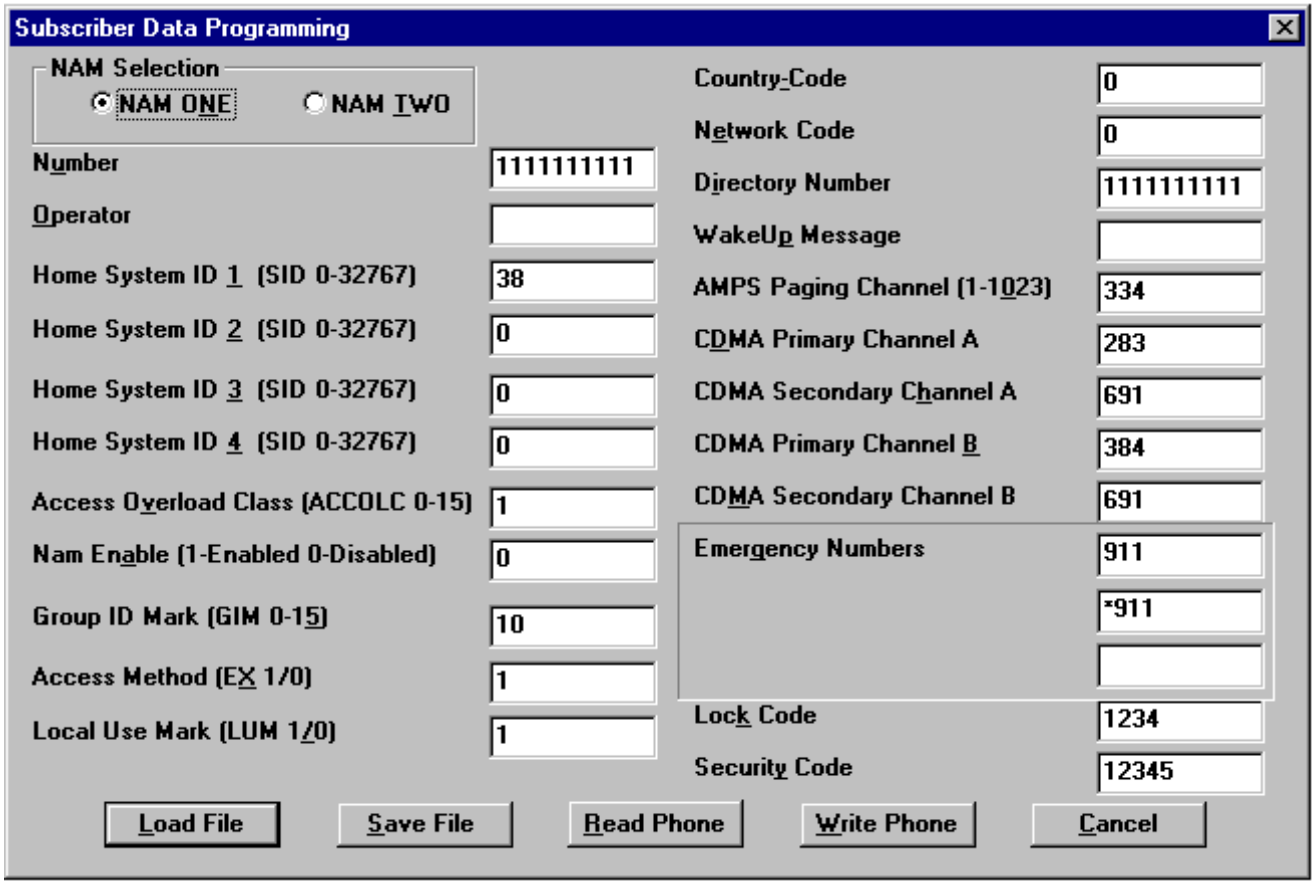
This option will reset all of the above.

View RF Parameters

Opens the RF parameters dialog for viewing this data.

Dealer Menu

NAM Programming



This option allows you to program the NAM information, wake up message, Emergency numbers, Lock code and security code of the phone.

Keys:

NAM Selection

Selects NAM contents to be displayed.

Load File

Prompts user to select a file containing NAM information.

Save File

Allows user to save screen contents to a file.

Read Phone

Reads phone contents to screen.

Write Phone

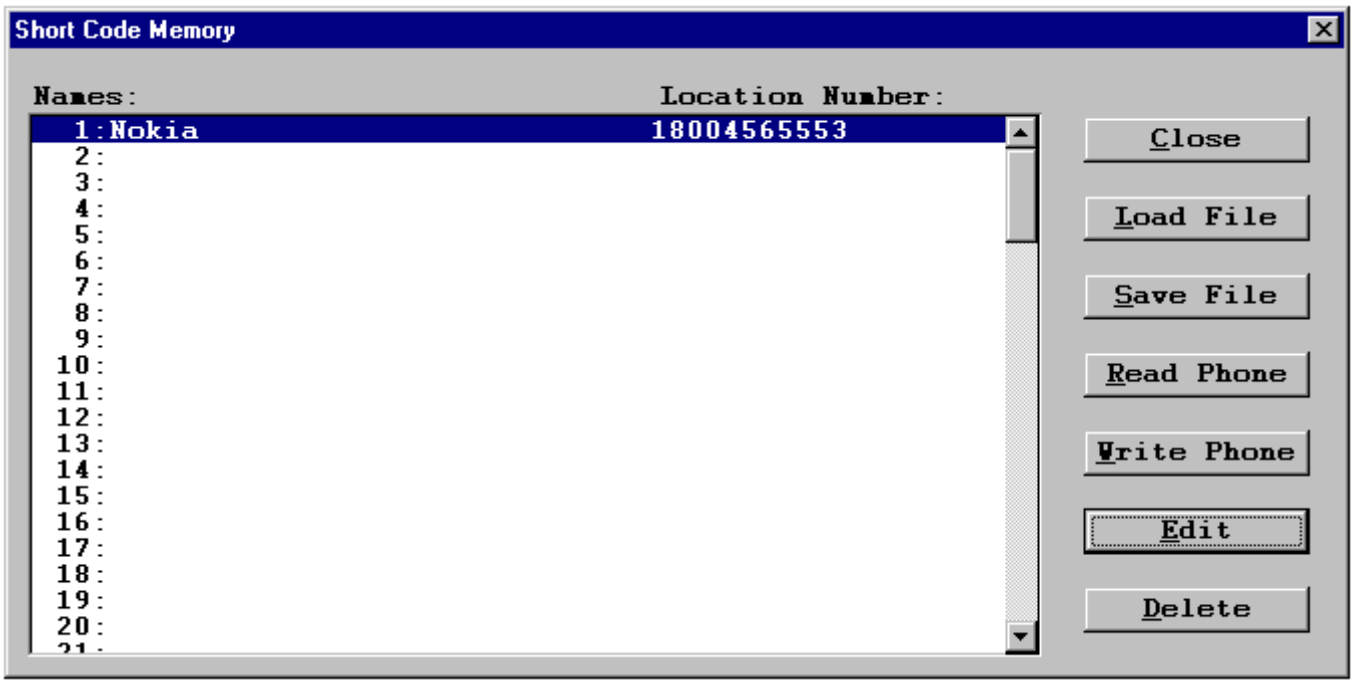
Writes contents of screen to phone.

Default NAM Parameter Settings

These settings apply to both NAM 1 and NAM 2 unless stated otherwise. Values are shown in decimal format.

Parameter	Default Setting	Valid Values
Own Number (Phone No. associated with NAM, more specifically known as the MIN)	000 000 XXXX (where XXXX is the last 4 digits of ESN)	10 digits;
Home SID List	SID 1 = Home System ID; All other SIDs are empty.	1 – 32767 for each SID. Up to 4 unique SIDs
Access Overload Class	last number of MIN	0 – 15
NAM Status	NAM 1: Enabled; NAM 2: Disabled	Enabled/Disabled
Group ID	10	0 – 15
Access Method	1	0,1
Local Use Mark	1	0,1
Country Code	0	0 – 999
Network Code	0	0 – 99
Directory Number (Phone No. associated with NAM, more specifically known as the MDN)	000 000 XXXX (where XXXX is the last 4 digits of ESN)	10 digits;
AMPS Paging Channel	If the HOME SYSTEM ID setting is odd, the A type channel default is used. If it is even, the B type paging channel default is used. A type channel: 333 B type channel: 334	0 – 2047
Primary CDMA Channel A	283	1 – 311
Secondary CDMA Channel A	691	689 – 694
Primary CDMA channel B	384	356 – 644
Secondary CDMA channel B	777	739 – 777
Emergency Numbers	911, *911, empty.	
Lock Code	1234	
Security Code	12345	

Short Code Memory (SCM)



This option allows the user to change the phone directory numbers (also known as short code memory).

Keys:

Close

Closes Short Code memory screen.

Load File

Prompts user to select a file containing Short Code Memory information.

Save File

Allows user to save screen contents to a file.

Read Phone

Reads phone contents to screen.

Write Phone

Writes contents of screen to phone.

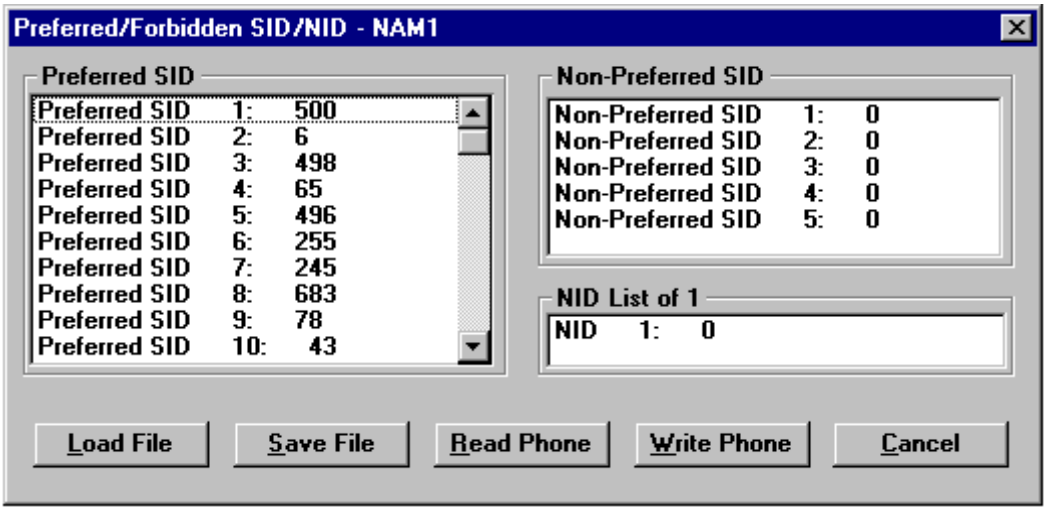
Edit

Edits the highlighted entry.

Delete

Deletes the highlighted entry.

SID Programming



This option allows you to edit the SID list. Highlight an entry using the <TAB> key and press enter to edit.

Keys:

Load File

Prompts user to select a file containing SID information.

Save File

Allows user to save screen contents to a file.

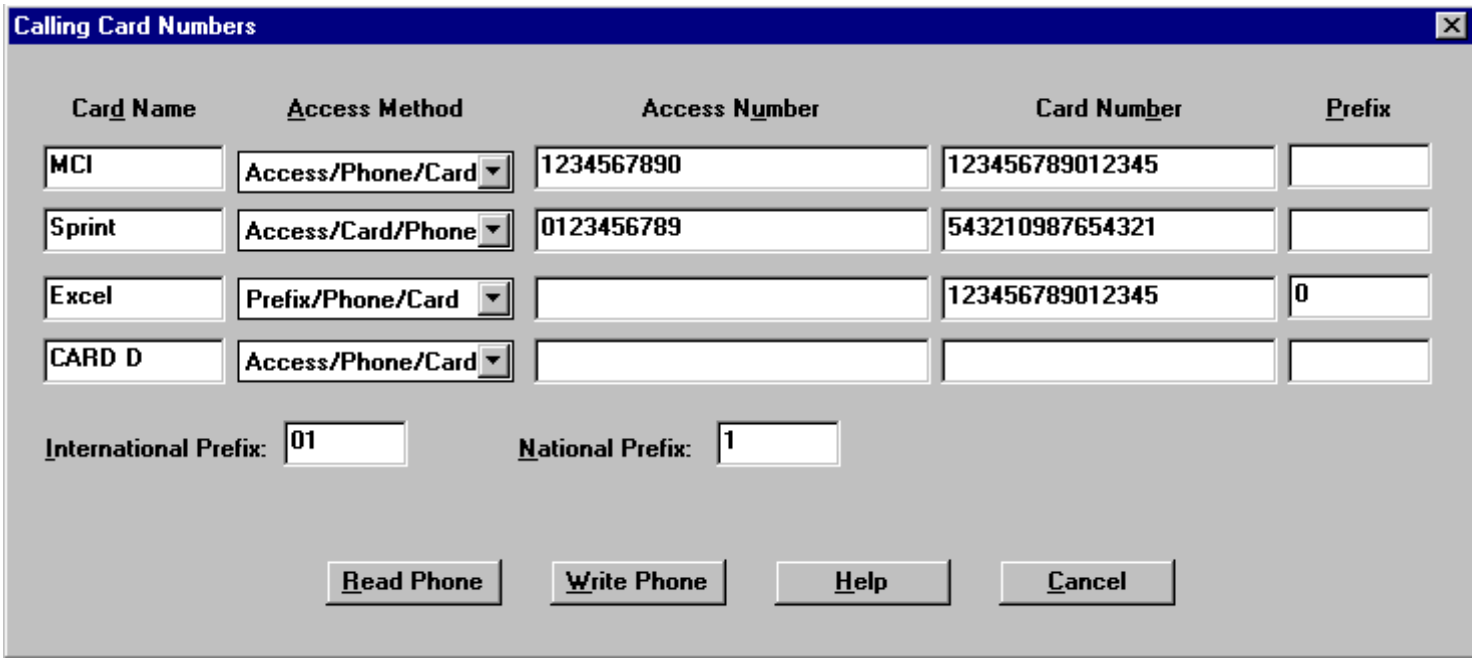
Read Phone

Reads phone contents to screen.

Write Phone

Writes contents of screen to phone.

Calling Cards



This option allows the user to program the calling card information into the phone.

Card Name

Allows user to change the name of the calling card display in the phones menu.

Access Method

Allows user to select the appropriate method for connecting with the service providers network according to the calling card requirements. Please contact your service provider for details or the calling card instructions. Changing this setting causes the phone to execute the sequence of events according to option choosen.

- Access/Phone/Card – sends the service providers Access number, then the Phone number being dialed by user, then Calling Card number.
- Access/Card/Phone – sends the service providers Access number, then Calling Card number, then the Phone number being dialed by user.
- Prefix/Phone/Card – sends the service providers Prefix number (typically a zero), then the Phone number being dialed by user, then Calling Card number

Access Number

The number used to access the service provders network. Typically a toll free number.

Card Number

Also known as “card ID”, this number is the actual calling card number issued by the service provider.

Prefix

This number is sent to gain system access. Typically a zero.

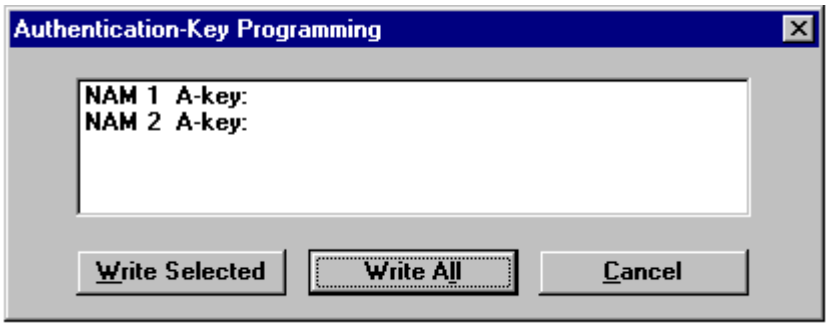
International Prefix

Currently not used.

National Prefix

Currently not used.

Authentication Key (A–Key) Programming



This option allows you to program the Authentication key of the phone. The A–key can *never* be read from the phone, only programmed to the phone over writing the previous value.

To program the A–key a valid A–key plus a valid checksum must be entered as one complete number.

- Valid A–Key number= 6 to 20 digits (e.g. XXXXXXXXXX)
- Valid checksum = 6 digits (e.g. YYYYYY)

Example:

- A–Key Entry would be XXXXXXXXXXYYYYYY

Keys:

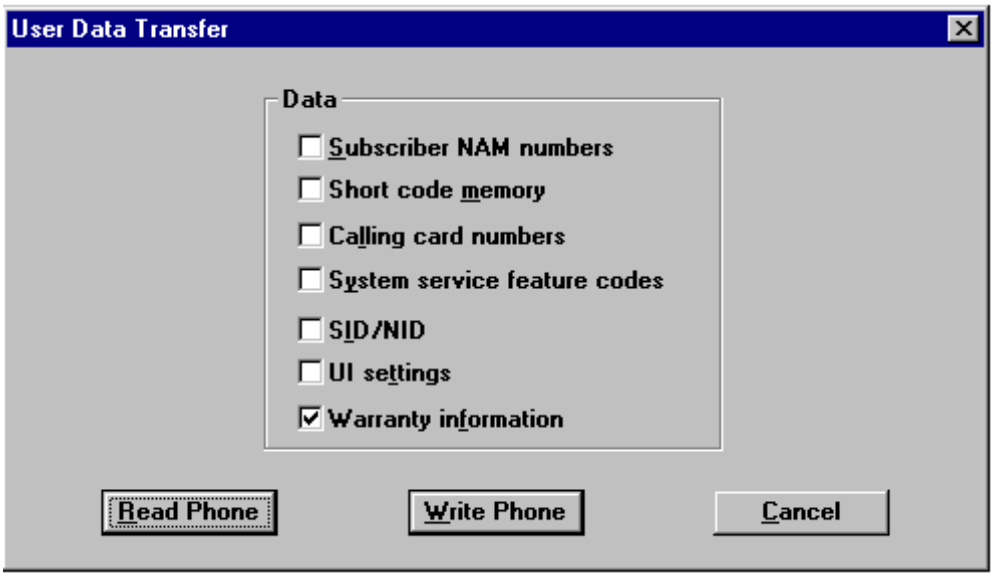
Write Selected

Writes the highlighted selection to the selected NAM in the phone if A–Key is valid. Otherwise an error message is displayed.

Write All

Writes both A–Key numbers to the corresponding NAM of the phone if the A–Key is valid. Otherwise an error message is displayed.

User Data Transfer



This option allows you to transfer the selected user data from one phone to another.

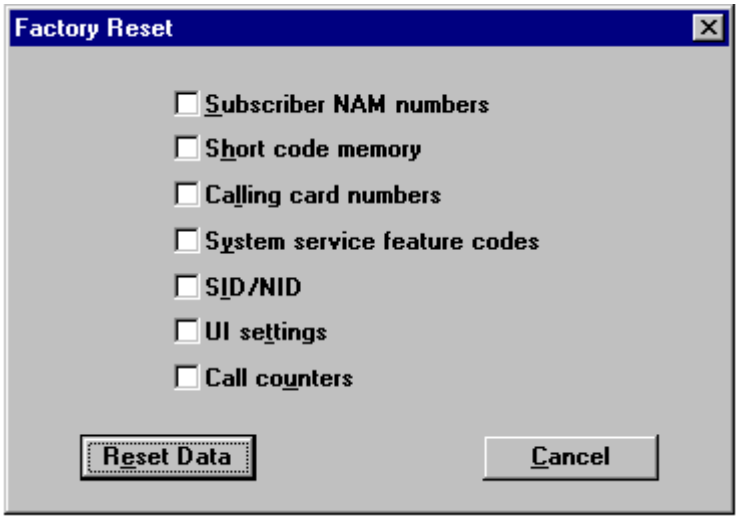
***Note**: The Warranty Information can not be unchecked and will always be transferred. The information can on;y be transferred to a phone once. After that an error dialog is displayed.*

If a phone should need to be replaced at the point of return, this option will read the selected information from the defective phone, allow the user to change to a new (replacement) phone, and write the users data into the replacement unit.

Steps involved

- With phone powered on, Connect defective unit and press <Read Phone>.
- Disconnect defective unit.
- Connect replacements unit and power on.
- Press <Write Phone>.

Set Factory Values



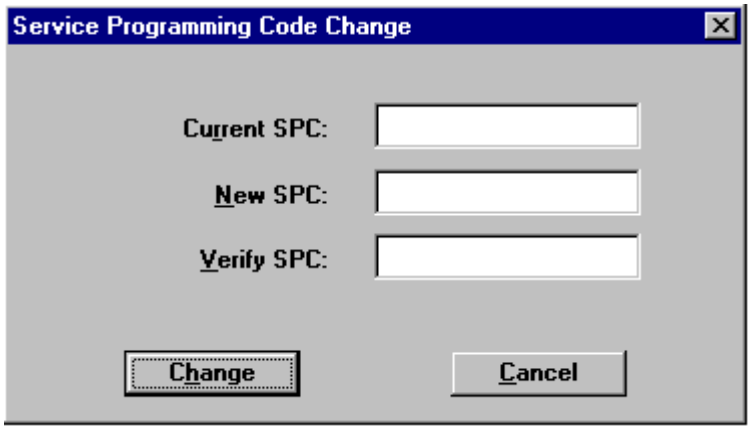
This option allows you to reset a phone's settings to their initial (factory) default values. The phone is also re–product profiled based on the product code.

The following list is a subset of data which can be reset to factory defaults:

- NAM information
- Clear Short Code Memory
- Calling Card information
- System Feature Codes
- System ID lists
- User Menu Settings
- Call Counters (except Life time counter)

Note: *This option will NOT erase any calibrated values within the phone.*

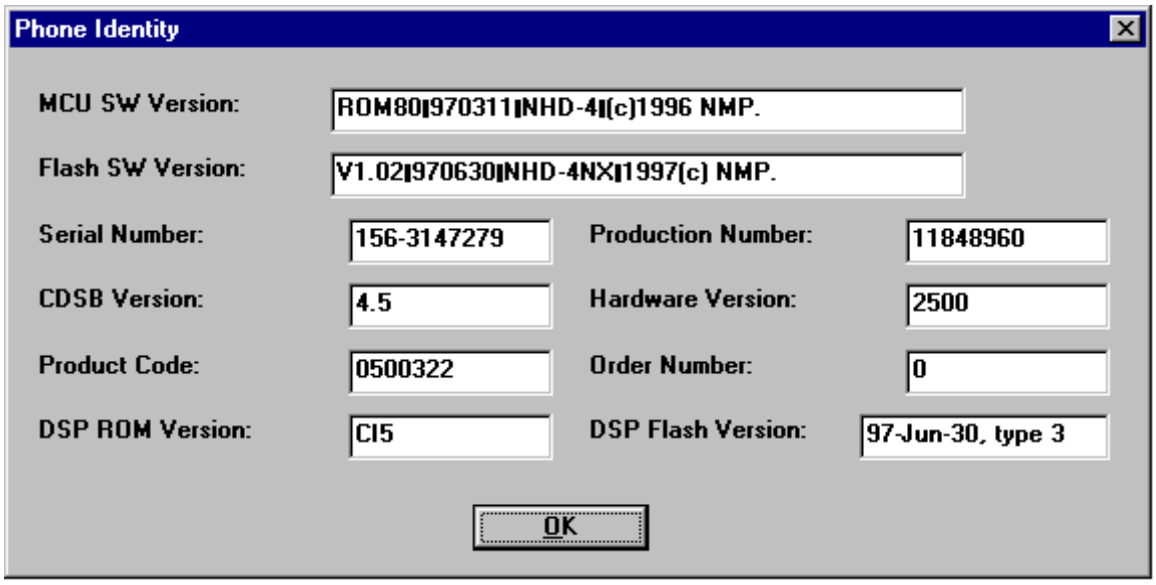
SPC code change



This option allows you to change the Subscriber Programming Code (SPC) if the original code is known.

View Menu

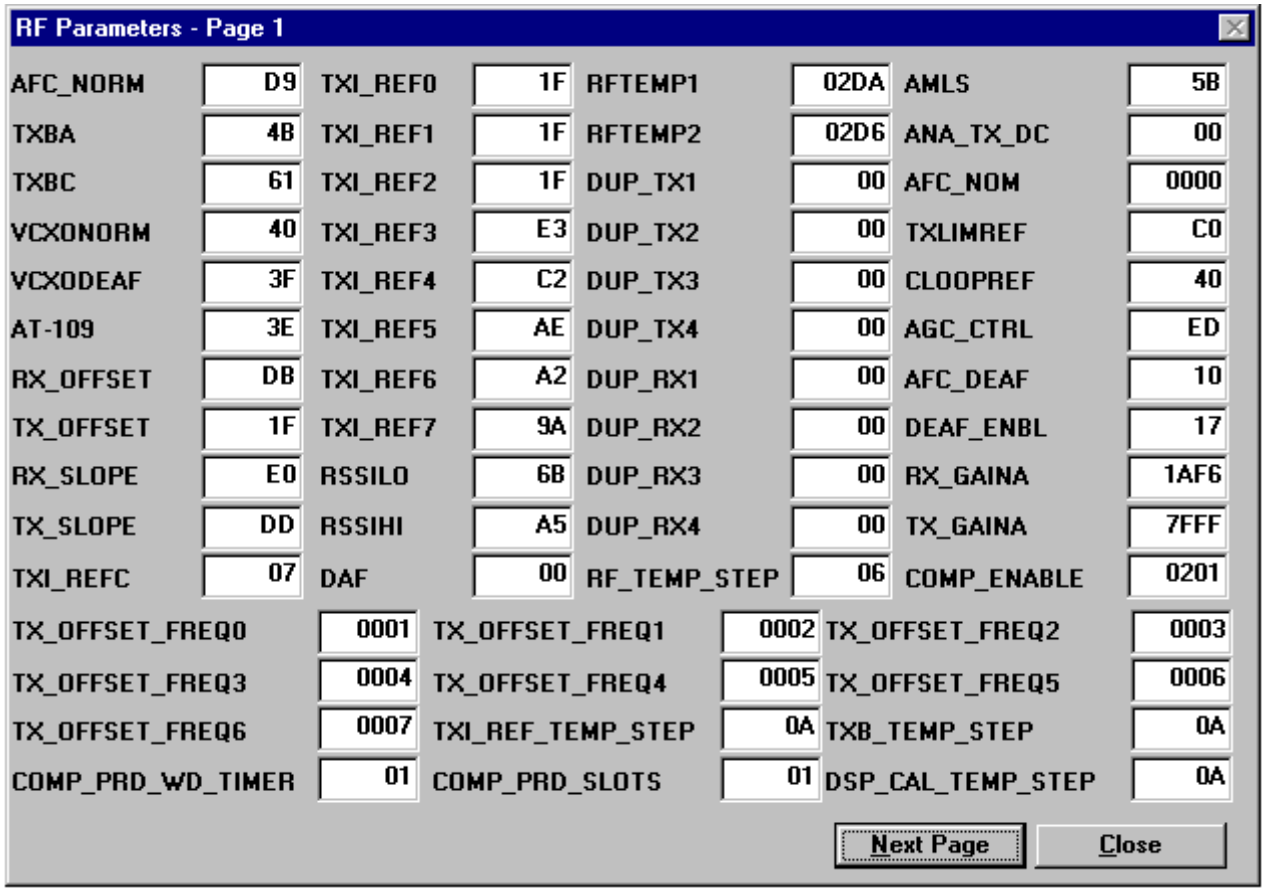
Phone Identity



This option displays the following phone identity fields:

- ROM version
- Flash version
- Production Serial Number (PSN),
- Order Number,
- Product Code,
- Hardware ID.

RF Parameters



This dialog shows the RF parameters of the phone. Looking at these parameters can help the technician in making decisions about the status of the phone.

Help

Index

A comprehensive list of all WinTesla features, hypertext linked.

General Help (F1)

This option contains two options:

– Help on using WinTesla

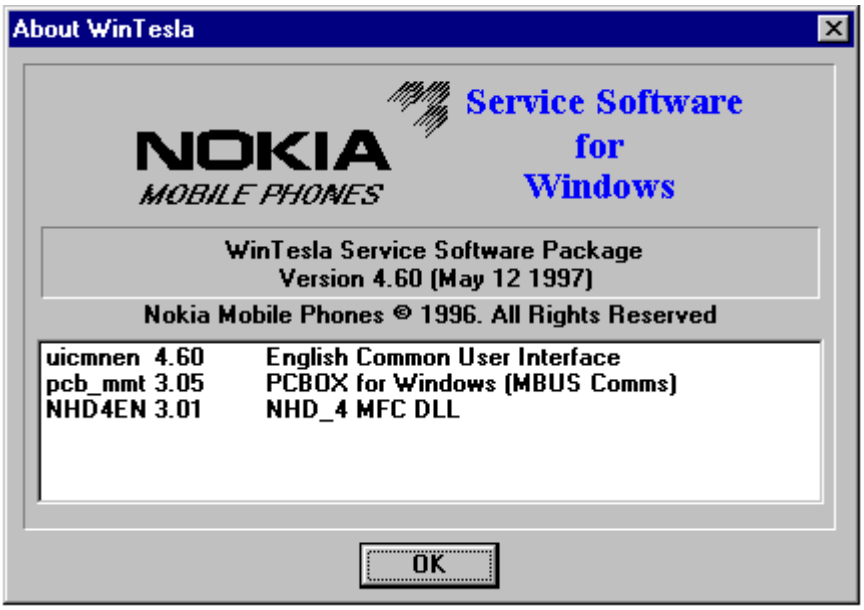
– Help on using Help

Using Help

This option provides you with information on using the online help function.

About WinTesla

Displays information on the the version that is running.



Common Problems

This section is a reference of known commo problems that may be encountered when working with the Wintesla software package.

Setting up the computer Hardware

In order to avoid some common hardware problem, please ensure the computer hardware is set up as follows.

COM Port Set up

COM port address (COM1 or COM2) should be set as the default values for these ports. Special port address or IRQ settings may encounter problems. to test this case set up a COM port as the default values and try running the Wintesla application again.

Printer port set up

The printer port is used to attach the PKD–1 software Protection Key. This device should work properly with most printer port settings. However, if a problem is encountered, change the computer printer port (LPT–1) setting to **"Standard AT type"**. This is NOT a Bi–directional setting.

***NOTE**: When using an FPS–3C flash programming set, the printer port MUST be set as **"Standard AT Type"**. The Flash box (FPS–3C) must have power connected.*

Common Errors

Error – Functionality DLL not found

This error will be encountered if a phone is connected to WIntesla and it is not recognized.

Solution

Install the Service Module for the phone type connected to Wintesla. Contact your local Nokia vendor for information on how to obtain this Service Module.

Error – PKD–1 not found

PKD–1 is the software **P**rotection **K**ey **D**evice that is required for the Wintesla application to run. This error will be encountered if the PKD–1 device is not installed on your printer port (LPT–1).

Solution

Attach the PKD–1 to the printer port (LPT–1) of the PC running Wintesla.

Error – System hangs or Locks up

Wintesla may hang or Lock up if it is being run on Windows 95 or NT.

Solution

Run the Wintesla application on Windows 3.1 or 3.11. The Wintesla application is NOT designed to run under Windows 95 or NT. If you are using Windows 3.1 or 3.11 and are still experiencing problems please call your local Authorized Service & Support location.

Error – Reset FPS–3 box

This error only occurs when reflashing a phone with new software.

Solution

Remove power from the FPS–3C box for approximately 5 seconds. Then reconnect power.

Error – Phone will not Tune properly

The phone can not be properly Tuned while connected to the FPS–3C flash box. The voltage coming from the box will cause errors in the tuning parameters.

Solution

Disconnect the FPS–3C box from the phone while Tuning. Only use one of the set up configurations listed in the Dealer Setups section of the NHD–4NX Service Manual.

Service and Support

Please contact your local Service location for more information and support .

Or try our web site (http://www.Nokia.com)

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